

Conversion Diagrams



R & M RADIO COMPANY

Radio Amateur and Industrial Electronic Supplies

1426 N. Quincy St.

Arlington, Virginia

INTRODUCTION

control and
con-

The R & M Radio Co. since its inception has been deluged with requests for schematic diagrams covering various conversions of war surplus equipment and in view of the many requests, R & M put their engineers to work - hence this book.

It would be impossible for anyone to cover all phases of conversions and modifications possible. However, the basic ones are covered and being "Hams" at heart ourselves, we know that most Hams will go so far on any conversion or modification and then get ideas of their own and come up with something different and probably better.

Here is a good start and we are open to suggestions; and request your comments or questions.

R & M Radio Co.

The Editor

Newest conversion book—complete
with schematic diagrams, instructions, and discussion—covers all
these war surplus sets:

DIAGRAMS AND CONVERSION DATA ON . . .

- BC-348
- BC-375
- SCR-522
- SCR-274
- SCR-274—10
meter mobile

ALSO DIAGRAMS COVERING . . .

- BC-221 Freq.
meter
- ART-13 Collins
transmitter
- APN-1
- SCR-718
- APN-4

SCR-274-N

The SCR-274-N Command Set though originally designed to operate from a 27 VDC power source, can, with a new power supply, become one of the most useful pieces of gear to be found in the ham shack. For instance; the transmitters perform admirably as V.F.O.-Driver units for high power final RF amplifiers, or, by themselves as small, lightweight 50 watt transmitters. Pursuing the former thought, the SCR-274-N combined with the BC-375-E will provide the Ham with a high powered transmitter with VFO Driver unit and the 274-N receivers complete his station; further, the modulator unit has the audio driver stage necessary to put the wallop needed into the BC-375-E audio circuit and will make those big bottles of the BC-375-E get up and perform in a manner of which they are capable.

The receivers are superhets and due to the fine workmanship and parts in them will stand a lot of abuse. They are designed to operate with a wide variety of conditions and may be powered by vibrator, 110 AC-DC, dry cells or most any kind of power at hand. By rewiring the filament circuits for six volts and supplying plate power from a small vibropack no better portable communication receiver set would be desired.

Figure 1—Gives the necessary rack FT-220 wiring changes for the use of the receivers and suggests a simple power supply which may be built up on the rack itself.

Figure 2—Shows connections to be made in changing adaptor FT-230 to FT-260.

Figure 3—Advances one of the many ways the modulator may be converted to use in conjunction with audio and RF driving power necessary to develop the sock of which the BC-375-E is capable.

Figure 4—Is practical wiring diagram of the modulator with unused parts marked.

Figure 5—Shows transmitter filament wiring changes to operate with 12 vac filament power.

Figure 6—Is original overall schematic of modulator-transmitter.

Figure 7—Original receiver schematic.

RECEIVERS

When the 274-N receivers are used with an AC supply it is not necessary to make any changes in the receiver wiring provided the filament voltage supplied is 24 volts AC or DC. We considered the question and decided it was much simpler to dig up a 24 volt supply than to change the filament wiring of three receivers. Casting about the junk box we found a 6 volt center tapped filament transformer and decided it would make a nice auto transformer if we had 12 volts to put across one half of it. This could be had if we put the two filament windings of our power transmitter in series. We did this and we had our 24 volts. How it is done is shown in **Figure 1** 274-N. Next thoughts were for a regular step up auto transformer. We remember of by gone years when six volt tubes* were plentiful but most transformers were equipped with 2½ volt filament windings. It was a neat trick then to take the core from an audio transformer and wind up another bobbin for it to step up 2½ volts to 6.3. This time we had a core of fair cross section so counting five turns per volt we put on 120 turns and took off a tap at 30 turns. With the power transformers 6.3 across the bottom and middle tap we got a nice 25 across the two outside terminals. This is also shown in **Figure 1**.

RECEIVER LOCAL CONTROL

The SCR-274-N Receivers BC-453-454-455 were designed for both remote and local control, but most are found

equipped for remote control only. For local control and adaptor with on-off switch, CW or MCW, and volume control resistor incorporated with it are used. (These adaptors, known as FT-260-A are practically unobtainable). The adaptor fits into the front of the receiver panel and is held in position by four small screws. For remote control, adaptor FT-230 is used. This is only a plug with one connection on it and has no controls on its face. It may be used to make an adaptor similar to the FT-260. Loosen the four screws holding FT-230 and by pulling out the knob in the center of its panel, it will come out. Remove the two small screws holding the cover over the plug and slip off the cover. You will find the eight prong plug supported by two aluminum shafts which are swaged to the cover. Remove these shafts for they will be in the way of the controls, also remove the knob from the front of the adaptor. Take the back and control knobs off remote control BC-450 and take out the receiver on-off switch and radio control. These may now be mounted on the FT-230 panel and connected to the socket plug from this unit. Connections are shown in **Figure 2**. Use leads that are a couple inches longer than necessary to reach from the receiver panel to the plug prongs to enable us to push the socket wafer on the prongs before screwing the FT-230 panel on the receiver side.

THE MODULATOR

Modulator BC-456 contains the dynamotor and its relays, the audio system and voltage divider networks for the SCR-274-N transmitters. The dynamotor is very nicely designed and built and puts out an astounding amount of soup for its size but we shall forget it in this writing and assume it will never be used. The audio circuit is a beam type transmitting tube, 1625, which has the carbon mike circuit directly to its grid and sans any amplifier stages ahead of it. This tube is used to suppressor grid modulate the pair of 1625's in the transmitter. There is the usual resistor-capacitor net work of voltage divider circuits and a VR-150 gas tube to stabilize and drop the screen voltage when the 274-N is on "voice".

Many service or war time audio circuits have only one tube doing service as an audio system. The explanation for this is simple. The carbon mike used carried more current than half the tubes could; 60 and sometimes 75 miles at 24 or less volts. With this sort of zip the mike, voltage stages are not necessary but we are dealing with civilian mikes that have not that sort of output so we must add a stage of audio in our modulator. This easy for there is a tube labeled V-50 in **Figure 3**, 274-N. This is equivalent of a 6-J-5. To some the idea of starting the infinite trickle of voltage from a crystal mike to a triode and then putting it to a high gain beam tube may sound a little backwards but it works out very nicely. First thing to do is start removing a few odds and ends that won't be necessary anymore. Refer to the Modulator Practical wiring diagram **Figure 4** to locate these parts for we have drawn diagonal lines through those not needed.

Namely, these will be three relays K-50, K-51 and K-52 (two of these are on top, under the tube cover), RF Choke L-150, mike transformer T-51, tone oscillator T-50.

Snip all the leads from J-54 for we won't need that plug at all and it will help clear the way under the chassis.

Where T-50 and T-51 come out there will now be room for mike jacks, gain controls and switches.

Now the **Figure 3** and **Figure 4** we can re-wire the modulator and take off from there to the few changes in the transmitters.

TRANSMITTER

The 274-N transmitters, when used as VFO, require very little change in wiring and this is in the filament circuits only. **Figure 5** gives these changes. These transmitters are so arranged that the crystal is not an integral part of the oscillator but is used instead to check the accuracy of same. For service use it was sufficient to check on one dial point only and assume the rest of the range correct enough. This would hardly do for civilian use but may be improved on by using crystals to check and confine the settings to proper bounds, for instance, two crystals may be used to mark the higher and lower band edges and thus assure the user of not trespassing on adjacent spectrums, or the user may wish a spot frequency and plug in the correct crystal, tune to resonance as usual just as though the circuit functioned as a crystal oscillator. The tuning procedure is simple to the extreme for it is only necessary to lift the rear tube cover, insert the crystal, leave the cover opened at an angle that will enable the ray tube glow to be seen in the little mirror riveted to the top, and tune the transmitter until the shadow angle of the tube is greatest. As the oscillator and power amplifier are ganged together this is all the tuning necessary other than to observe if tuning the antenna loading circuit has any effect on the frequency. Care must be taken in loading as is the case in all VFO's.

Dial calibration may be lined up to the proper frequency by inserting a small insulated screw driver through the hole in the top back portion of the transmitter that is covered by a snap slide. This will reach a small trimmer condenser in the oscillator circuit.

For ease in tuning to any crystal it is suggested that a small meter be put either in the cathode or plate circuit of the target tube and mounted on the transmitter where it may be easily seen. This will make any appreciable drift immediately apparent, however, the variation is small and some circuit modification base. This may necessitate an adaptor to allow the crystal holders usually found in the shack to be used in the set although there are several types on the market that can be plugged into an octal socket.

The final amplifier is coupled to the antenna loading circuit by a variable coupling loop that is fastened to a shaft within the final plate tank if it is desired, this loop may be utilized to connect to a low impedance line and well serve to carry the output to an antenna or power amplifier.

The loading coil may be used to resonate a random length wire antenna or may be tuned by the addition of an other condenser and coupled directly to the grid of a following amplifier.

Still another thought is to remove the antenna tuner coil and substitute the usual plug-in coil and condenser. The later would probably be the most efficient if the user contemplated doubling in the following stage for much loss would result in the shorted turns of the antenna coil.

When the transmitter is to be used without the following stage it would be handy to install a co-ax connector in the panel face to enable the user to couple to low impedance feeders such as center fed antennas sometimes use.

Figure 5 gives the necessary detail for wiring changes for 274-N transmitters for operation from 12 volt AC filament supplies.

TUNING BY CALIBRATING CRYSTAL

In order to test the theory that more than one crystal

could be used in parallel in place of the one supplied. It was decided to put six crystal in the place of the one.

For testing purposes an adaptor was made up from a thin bakelite strip $1\frac{1}{4}$ " wide. This was mounted vertically from the center of an octal tube base. Tube prong jacks removed from six prong tube sockets were mounted on the strip to allow three crystals to be mounted on each side. The six crystals were ganged in parallel in place of the single original rock and were separated in frequency by 10 kc. In the set-up there was found no interaction, the adjacent channels were easy to locate by the target tube shadow. By careful tuning, the frequency was plus or minus 100 cps, the crystal frequency, with ease. By tuning within the range of the target tube shadow movement the frequency could be varied 500 to 2,000 CPS depending on the transmitter used. The same condition existed for any frequency covered by the transmitter dial markings. The dials are marked off in 10 kc steps and are driven by a reduction gear from the small knob in lower right hand of the panel. By removing the knob and fixing a small disc to it which had been marked off in 20 divisions we have a vernier control. One-fifth revolution of the vernier covers about 10 kc on the main dial of the 7-9 mc transmitter and one-third revolution on the 3-4 mc.

A Word About The Stability Of SCR-274-N Transmitters

When modulated by the original screen grid method the frequency is apt to swing a good many hundred cycles if the final is too heavily loaded. Completely removing the load from the final and replacing it will cause a frequency drift of roughly 5,000 cycles.

For perfect operation a VR tube, stabilized oscillator plate voltage or some similar arrangement would be necessary. The original circuit has a VR tube in the final amplifier screen grid circuit which is used to drop and stabilize the screen voltage of the final to allow modulation via that grid. As the oscillator operates at 250 volts plate and the small amount of frequency variation noticed was caused by voltage drop along the divider resistor network of the modulator, perhaps it would be easier to supply the oscillator plate voltage from a nearby receiver or separate small supply. As it stands the variation is not objectionable if properly handled.

In the transmitter schematic there will be noticed R-77 and R-70 of the resonance indicator which form the cathode resistors of this tube. With these two resistors for forming the target bias the indication is small at the resonance peak and difficult to see in a bright light. R-70 originally placed a positive voltage upon the cathode from the 27 VDC to provide constant biasing of the tube. With AC on the filaments is should be removed and as R-70 is the right value should be put in place of the cathode resistor R-77. This will greatly improve the target shadow swing and facilitate tuning.

One method tried works nicely for controlling the transmitters. The relays were removed and rewound by filling the bobbins with 24DCC wire. This allowed them to be operated by a small three volt battery pack.

For mobile use many of the gang and also several branches of the government service have used the familiar PE-103 dynamotor to power the 274-N transmitter and modulator. PE-103 has a 12 or 6 volt input and 500 volts at 160 mills. By feeding 6 volts into the dynamotor, 12 volts and 500 may be taken out. By re-wiring the filament circuits and the relays for 12 volts plus a lower value of resistance in the mike supply circuit the equipment may be used exactly as it was in the aircraft.

For crystal control a clever scheme has come to our

attention. In the original circuit the oscillator grid leak and capacitor are in series with the grid. By changing the grid leak position so that it will go from grid to ground and placing the grid capacitor in a crystal holder, crystals may be placed in series with the grid circuit. This in effect forms a crystal filter and will not permit the circuit to function at any frequency but that of the crystal. By removing the crystal and replacing the condenser the circuit is again a VFO.

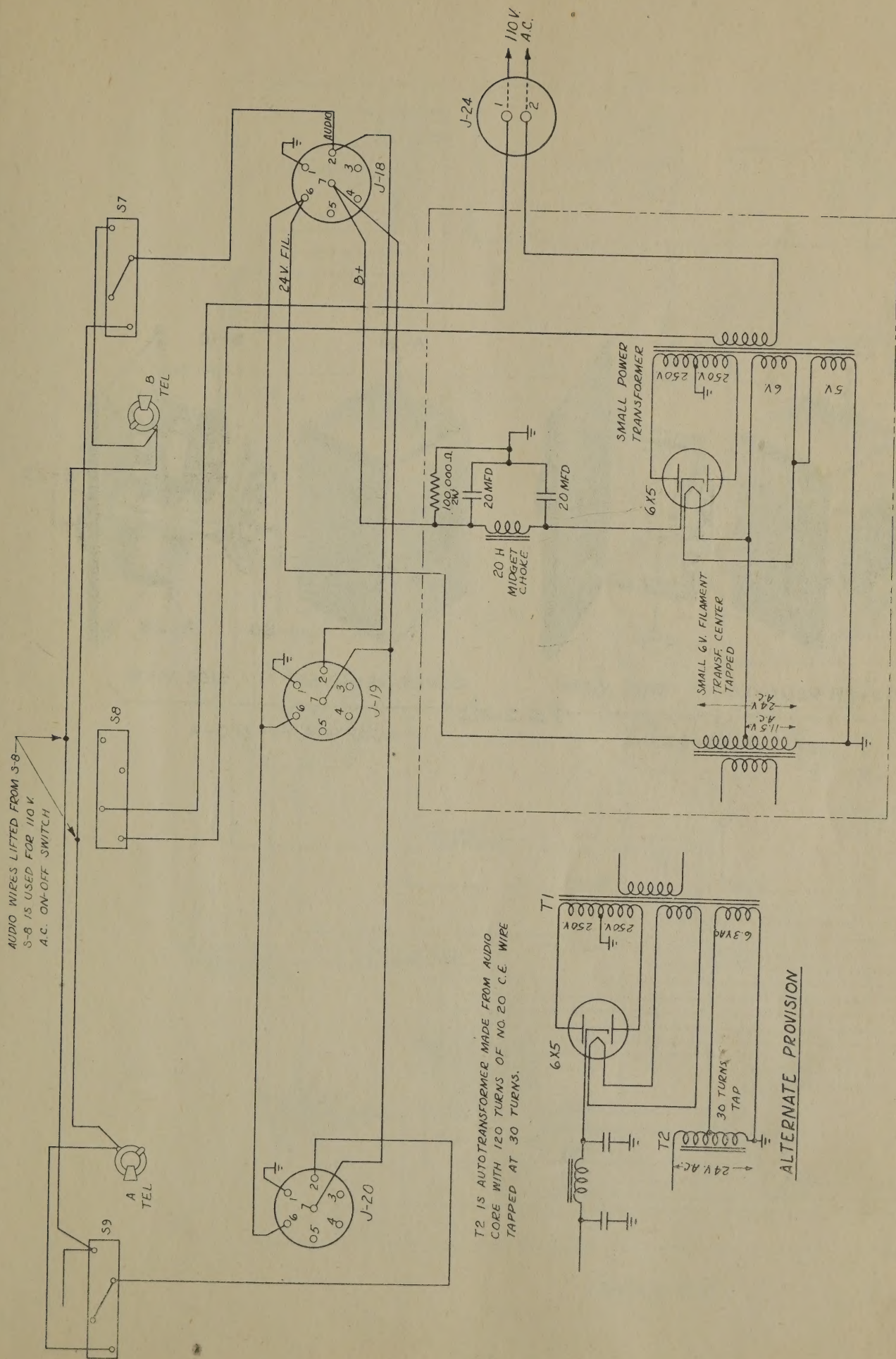
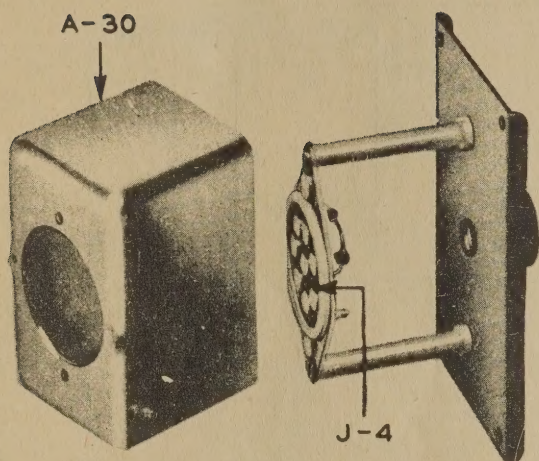


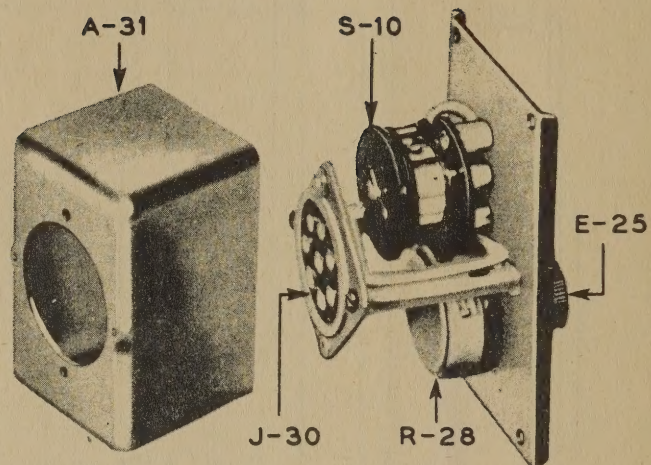
FIGURE 1-274N



COVER REMOVED

SIDE VIEW

ADAPTER FT-230-A

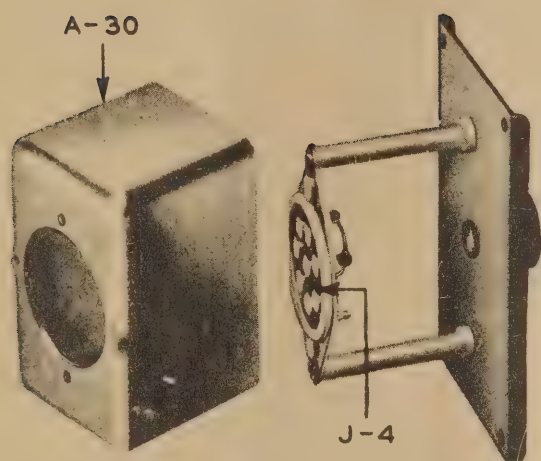


COVER REMOVED

SIDE VIEW

ADAPTER FT-260-A

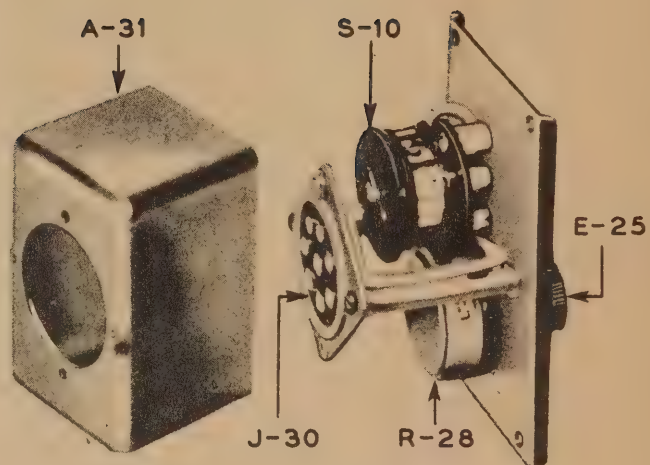
FIG. 2-274



COVER REMOVED

SIDE VIEW

ADAPTER FT-230-A



COVER REMOVED

SIDE VIEW

ADAPTER FT-260-A

FIG. 2-274

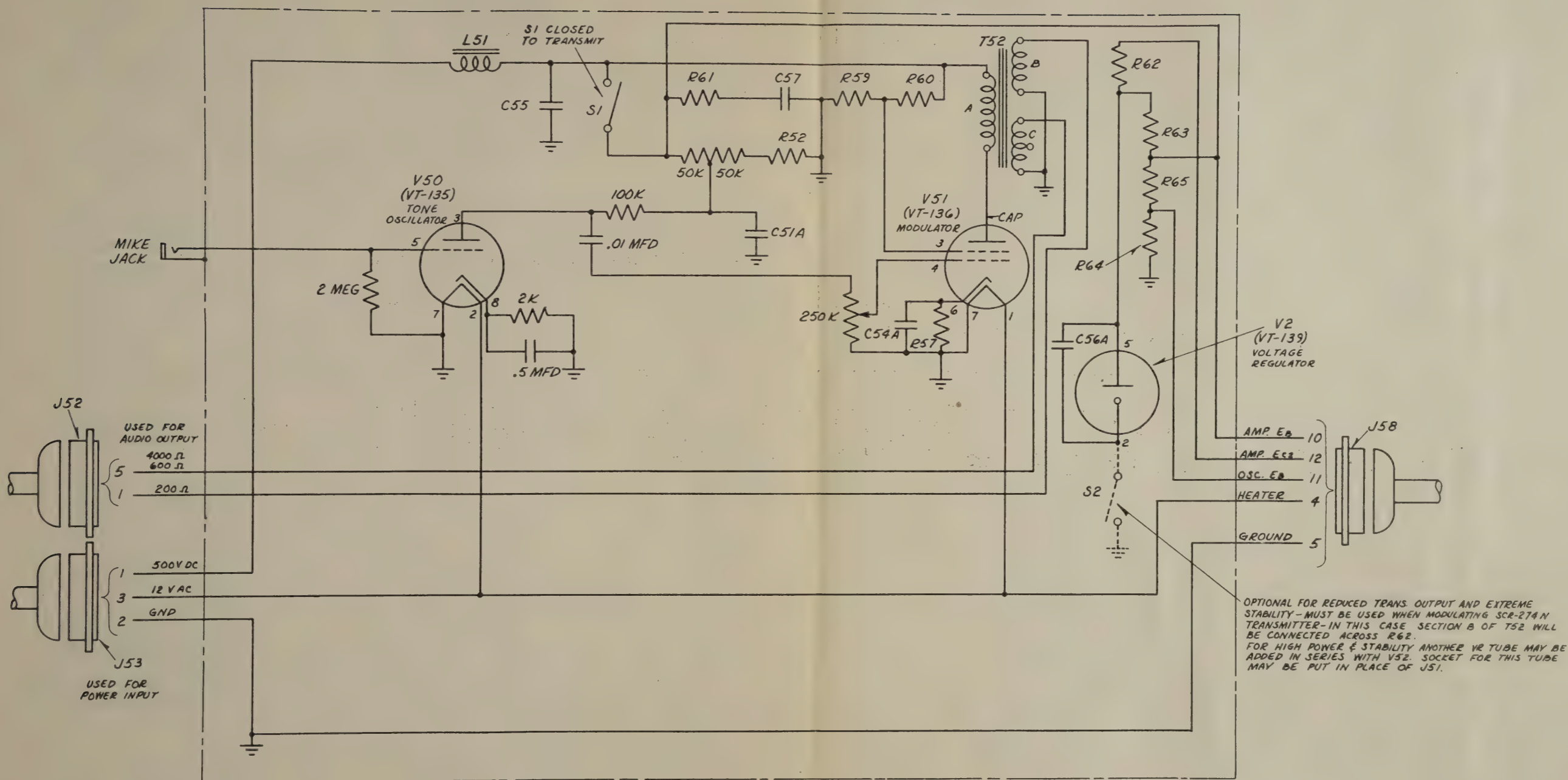
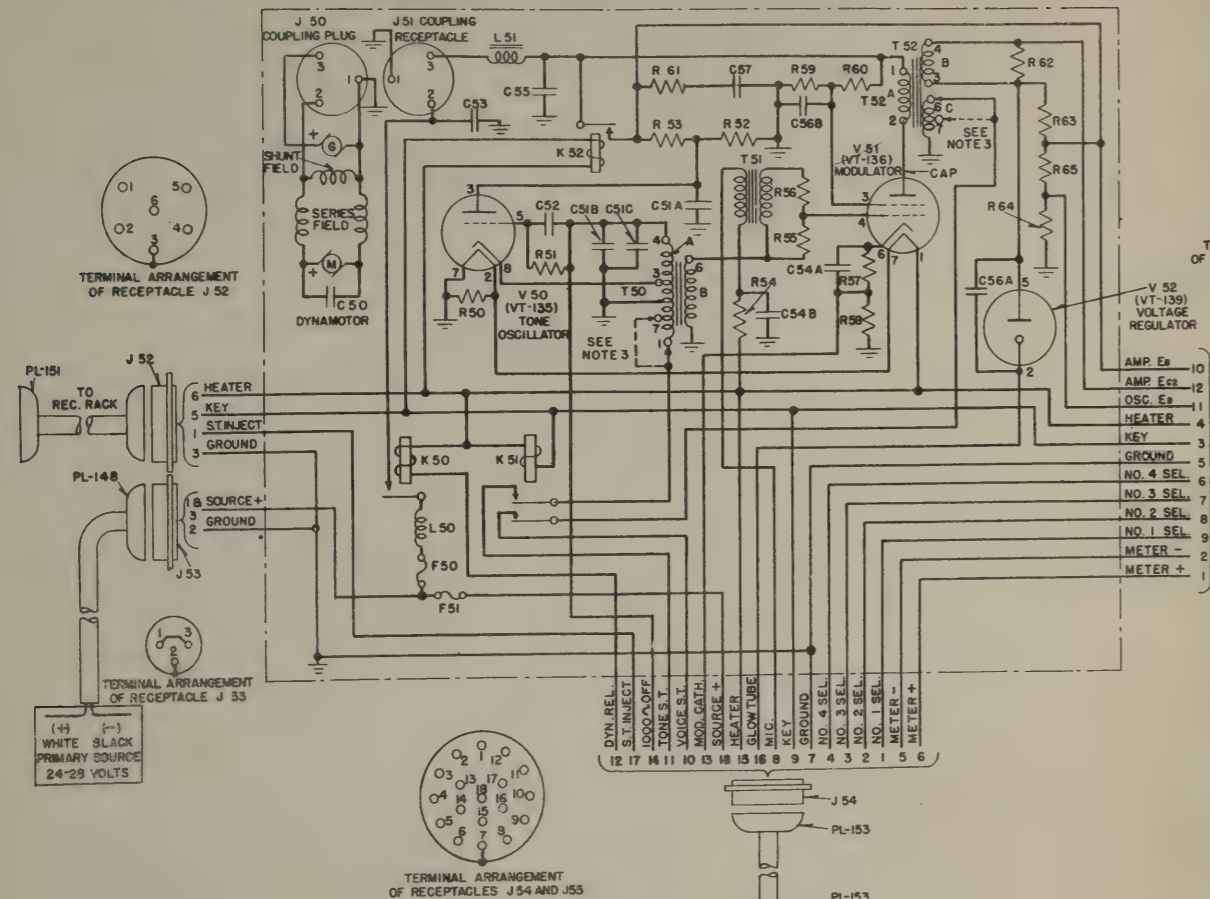


Fig 3-274-N

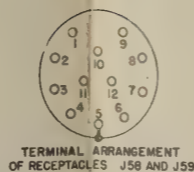
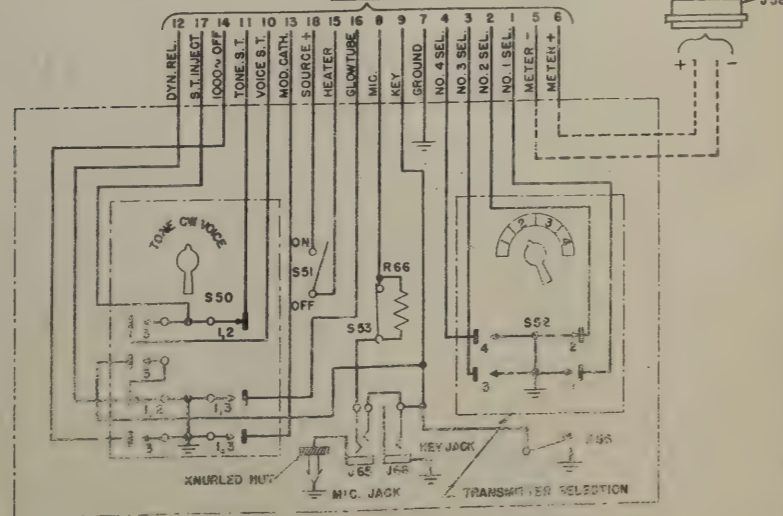
MODULATOR UNIT BC-456-A(OR-B) WITH DYNAMOTOR DM-33-A



NOTES ON SWITCHES S 50, S 52 AND S 53
THE NUMBERS ON THE VARIOUS CONTACTS REFER TO THE POSITIONS OF THE SWITCH LEVERS AT WHICH THESE PARTICULAR CONTACTS ARE CLOSED BY THE ACTION OF THE SWITCH. ON S 50, "TONE" IS 1, "CW" IS 2, AND "VOICE" IS 3.
S 53 SHOULD ALWAYS BE KEPT IN "R OUT" POSITION AS INDICATED ON THE RED PLATE FOR SATISFACTORY OPERATION WITH MICROPHONE T 17, T 30 OR EQUAL.

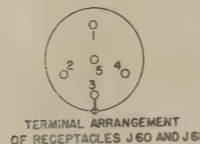
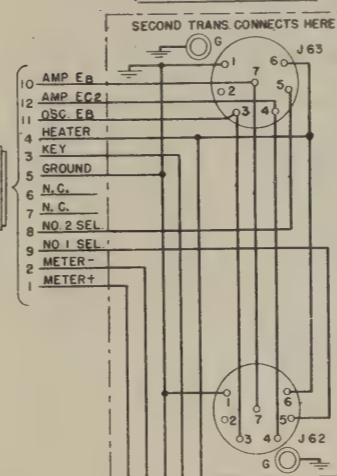
NOTE ON MICROPHONE JACK J 55
THE KNURLED BUT IS USED TO GROUND THE SLEEVE OF JACK J 55 WHEN A MICROPHONE EQUIPPED WITH A PUSH-TO-TALK SWITCH, SUCH AS MICROPHONE T 17, IS USED. WHEN THE JACK SLEEVE IS NOT GROUNDING, THE PUSH-TO-TALK FUNCTION MUST BE PERFORMED BY KEY T 56 OR AN EXTERNAL KEY OR SWITCH CONNECTED TO JACK J 55.

RADIO CONTROL BOX



TERMINAL ARRANGEMENT OF RECEPTABLES J58 AND J59

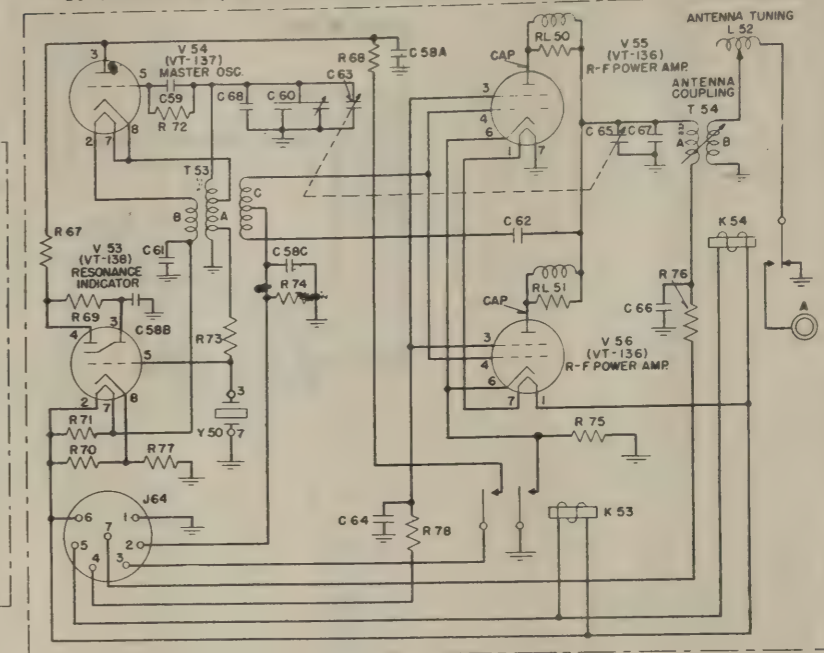
RACK FT-226-A (TWO TRANSMITTERS)



TERMINAL ARRANGEMENT OF RECEPTABLES J60 AND J61

* NOTE ON SWITCH S 54
SWITCH S 54 AND CONNECTIONS SHOWN IN DASHED LINES WERE PROVIDED IN EARLIER MODELS OF ANTENNA RELAY UNIT BC-442-A. LEAD "A" WAS LEFT OUT IN UNITS WHERE S 54 WAS USED.

TYPICAL RADIO TRANSMITTER BC-696-A(3-4 MC), BC-457-A(4-5.3 MC), BC-458-A(5.3-7 MC) OR BC-459-A(7-9.1 MC)

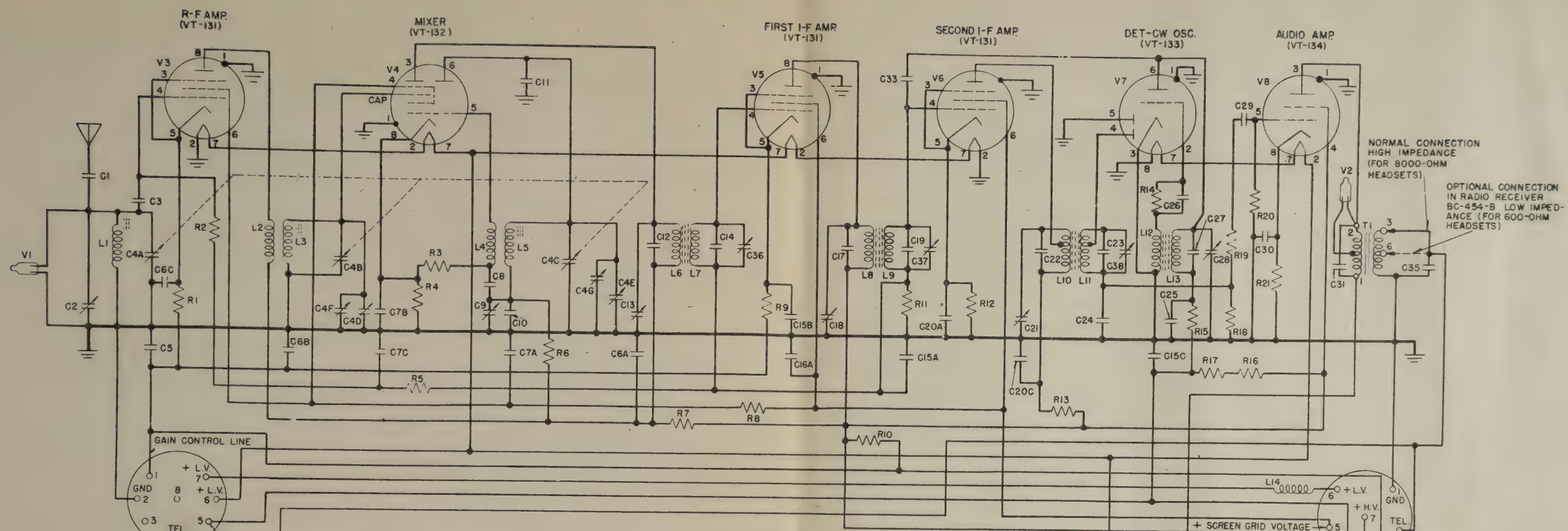


- NOTES**
- ALL RELAYS ARE SHOWN IN THE NON-ENERGIZED POSITION.
 - ALL COUPLING PLUGS AND RECEPTABLES SHOWN AS VIEWED FROM THE OUTSIDE. ALL PLUGS AS VIEWED FROM THE CORDAGE END HAVE THE SAME ORIENTATION OF CONDUCTORS AS THAT SHOWN HERE FOR THEIR RESPECTIVE RECEPTABLES.
 - TRANSFORMERS T 50 AND T 52 IN MODULATOR UNIT BC-456-B ARE PROVIDED WITH SIDETONE TAPS FOR LOW IMPEDANCE HEADSETS (ON T 50 AND 7 ON T 52). MODULATOR UNITS BC-456-A AND BC-456-B ARE NORMALLY FURNISHED WITH CONNECTIONS SHOWN IN SOLID LINES FOR USE WITH HIGH IMPEDANCE (8000 OHMS) HEADSETS. MODULATOR UNIT BC-456-B CAN BE CHANGED FOR USE WITH LOW IMPEDANCE (500 OHMS) HEADSETS BY SUBSTITUTING CONNECTIONS SHOWN IN DASHED LINES.
 - TERMINAL NUMBERS APPEARING ON RECEPTABLES OF JACK J 51 IN MODULATOR UNIT AND J 64 IN TRANSMITTER AND ALL CIRCUIT SYMBOLS ARE FOR REFERENCE PURPOSES ONLY. THEY DO NOT APPEAR ON THE EQUIPMENT.
 - * DISCONTINUED ON LATER EQUIPMENTS.

ANTENNA RELAY UNIT BC-442-A OR ANTENNA RELAY UNIT BC-442-AM (LESS C-69 AND BINDING POSTS "C")

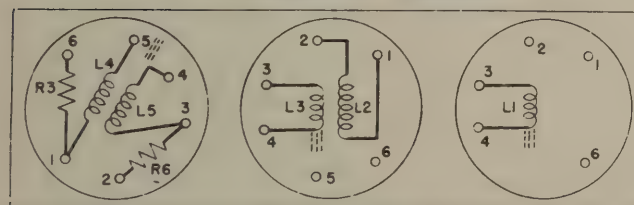
CAPACITORS		INDUCTORS		RELAYS & KEYS		RESISTORS		SWITCHES		TRANSFORMERS		MISCELLANEOUS	
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	OHMS	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
C 50	.005	L 50	RF CHOKE APPR 15 MICRONHRES	K 50	DYNAMOTOR INPUT	R 50	42	S 50	CHOICE OF EMISSION	T 50	VOICE OSC	TC 50	THERMOCOUPLE
C 51(A,B)	.001	L 51	1.7 HENRIES	K 51	SIDETONE, VOICE AND TONE	R 51	100,000	S 51	MAIN "ON-OFF"	T 51	MICROPHONE MODULATION	M 50	ANT. CURRENT INDICATOR (LOCAL)
C 52	.001	L 52	ANT. TUNING INDUCTOR	K 52	DYNAMOTOR HIGH VOLTAGE (KEYING)	R 52	300,000	S 52	BATTERY LINE	T 52	MASTER OSC	Y 50	CRYSTAL UNIT
C 53	1.2			K 53	SELECTOR	R 53	91,000	S 53	SHUNTS MIC	T 53	TRANS OUTPUT	F 50	20 AMP FUSE
C 54(A,B)	5.2			K 54	TRANSMITTER OUTPUT	R 54	200	S 54	SERIES RESISTOR	T 54	ANT CURRENT	RL 50	PARASITIC SUPPRESSOR
C 55	1.2			K 55	ANTENNA SWITCH-BNG REC TO TRANS	R 55	2,000		METER SWITCHING			RL 50	PARASITIC SUPPRESSOR
C 56(A,B)	.57.5			K 56	BUILT-IN KEY	R 56	13,000						
C 57	.05					R 57	390						
C 58(A,B)	.05					R 58	50,000						
C 59	.0006					R 59	30,000						
C 60	ANT. PARASITIC					R 60	75,000						
C 61	.006					R 61	20						
C 62	RF. PARASITIC					R 62	10,000						
C 63	RF. PARASITIC					R 63	20,000						
C 64	RF. PARASITIC					R 64	100,000						
C 65	RF. PARASITIC					R 65	15,000						
C 66	RF. PARASITIC					R 66	510						
C 67	RF. PARASITIC					R 67	51,000						
C 68	RF. PARASITIC					R 68	20						
C 69	RF. PARASITIC					R 69	100,000						

FIGURE 6-374N



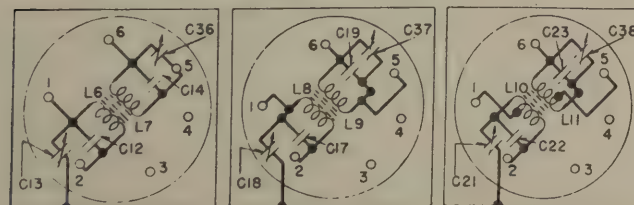
GAIN CONTROL LINE
J1 AS VIEWED FROM OUTSIDE
CW OSC. SHUT-OFF LINE
SEE SCHEMATIC DIAGRAM OF RECEIVING EQUIPMENT FOR JACK CONNECTIONS

DETAIL SCHEMATIC DIAGRAMS COIL ASSEMBLIES AND TRANSFORMERS



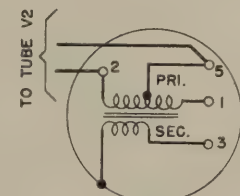
SYMBOL 25C R-F OSCILLATOR
SYMBOL 25B R-F AMPLIFIER
SYMBOL 25A R-F ANTENNA

R-F COIL UNIT (3-6 MC) SYMBOL Z5

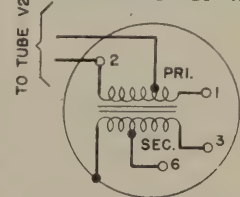


SYMBOL Z1 1ST I-F 1415 KC
SYMBOL Z2 2ND I-F 1415 KC
SYMBOL Z3 3RD I-F 1415 KC

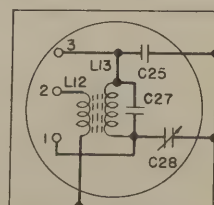
I-F COUPLING UNITS



SYMBOL T1
OUTPUT TRANSFORMER
RADIO RECEIVER BC-454-A



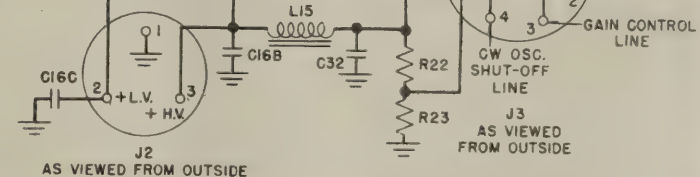
SYMBOL T1
OUTPUT TRANSFORMER
RADIO RECEIVER BC-454-B



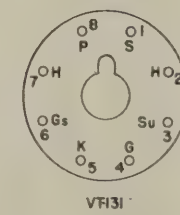
SYMBOL Z4
CW OSCILLATOR
1415 KC

CAPACITORS		INDUCTORS		RESISTORS	
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	OHMS
C1	11 MMF	L1	ANT. INPUT	R1	620
C2	15 MMF	L2, L3	RF AMP.	R2	2,000,000
C3	100 MMF	L4, L5	RF OSC.	R3	51,000
C4 (A TO G)	GANG (147 MMF)	L6, L7	IN 1ST IF	R4	620
C5	3 MF	L8, L9	IN 2ND IF	R5	150,000
C6 (A,B,C)	.05/.05/.05 MF	L10, L11	IN 3RD IF	R6	200,000
C7 (A,B,C)	.05/.05/.05 MF	L12, L13	CW OSC.	R7	200
C8	200 MMF	L14	RF CHOKE, 112	R8	200
C9	40 MMF		MICRO-HENRIES	R9	620
C10	365 MMF	L15	AF CHOKE	R10	360,000
C11	3 MMF		3 HENRIES	R11	100,000
C12	180 MMF			R12	510
C13	17 MMF			R13	200
C14	180 MMF			R14	100,000
C15 (A,B,C)	.05/.05/.05 MF			R15	5100
C16 (A,B,C)	.22/.22/.22 MF			R16	51,000
C17	180 MMF			R17	51,000
C18	17 MMF			R18	510,000
C19	180 MMF			R19	100,000
C20 (A,B,C)	.05/.01/.05 MF			R20	2,000,000
C21	17 MMF			R21	1500
C22	180 MMF			R22	7000
C23	180 MMF			R23	7000
C24	200 MMF				
C25	.001 MF				
C26	100 MMF				
C27	180 MMF				
C28	34 MMF				
C29	.006 MF				
C30	15 MF				
C31	.001 MF				
C32	5 MF				
C33	*				
C34	750 MMF				
C35	17 MMF				
C36	17 MMF				
C37	17 MMF				
C38	17 MMF				

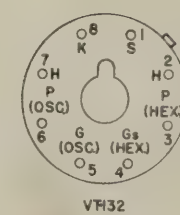
* WIRING CAPACITANCE (LESS THAN 2 MMF).



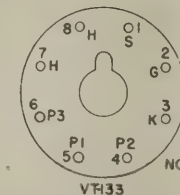
AS VIEWED FROM OUTSIDE



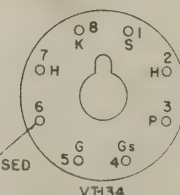
VT-131



VT-132



VT-133



VT-134

TUBE SOCKET TERMINALS AS VIEWED FROM BOTTOM
G=CONTROL GRID
G (HEX)=CONTROL GRID, HEXODE SECTION
G (OSC)=CONTROL GRID, OSC SECTION
Gs=SCREEN GRID
Gs (HEX)=SCREEN GRID, HEXODE SECTION
H=HEATER
K=CATHODE
P=PLATE
P (HEX)=PLATE, HEXODE SECTION
P (OSC)=PLATE, OSC SECTION
P1=FIRST DIODE PLATE
P2=SECOND DIODE PLATE
P3=TRIODE PLATE ON TUBE VT-133
S=SHELL
Su=SUPPRESSOR GRID

CIRCUITS IN R-F COIL SET, I-F COUPLING UNITS, CW OSCILLATOR, AND OUTPUT TRANSFORMER. THE TERMINAL NUMBERS ON THESE UNITS AGREE WITH THOSE SHOWN AT THE CORRESPONDING LOCATIONS ON THE PRACTICAL WIRING DIAGRAM.

FIGURE 7-274N

BC-375-E TRANSMITTER

As it stands, the BC-375-E is a master oscillator power amplifier type transmitter. It has been proven to most amateurs that it is not wise to use it in the present form for much difficulty would be experienced in trying to keep within frequency tolerances and the transmitter will not produce the power it is capable of or built to stand. It is our suggestion that the transmitter be revamped to allow it to use the present oscillator stage as a power amplifier. It is also our suggestion that the SCR-274-N command set transmitter and modulator be used as driver stages for both audio and RF for it is a "natural" for the job and is available at low prices.

Present audio input of BC-375-E is for carbon mike, directly to the grid of the driver stage of a class "B" set-up. The driver is a "210" type tube and will do the driving nicely if sufficient audio voltage is applied to the grid of this stage.

The oscillator of BC-375-E when re-wired to function as a power amplifier or doubler requires quite a bit of power to drive it well, and this may be furnished by the SCR-274-N transmitter. This particular unit is suppressor grid modulated, has approximately fifty watts output at max coupling and is a "bang up" fine business VFO. We have only to utilize the modulation voltages of the 274-N to drive the BC-375-E audio and the RF output of the same equipment to drive the RF and we have a very fine rig at the lowest possible cost.

The information given here is not offered as the acme of ways to use the BC-375-E and may not be entirely scientific in its approach but it will serve as a rough guide and when used will give the amateur a thought to build upon and work out his own needs and ideas.

Three drawings are included, Figure 1, BC-375-E is the original circuit schematic. Figure 2, 375 is a practical wiring diagram which is necessary to show positions and wire placements. Figure 3, 375, Figure 3, 274-N, Figure 5, 274 shows schemes suggested above.

The BC-375-E has the necessary components to work over into many different rigs or it may be left in its original form or torn apart and re-assembled.

The proud possessor of a newly acquired BC-375-E may be somewhat cowed or intimidated by the appearance of the inside of the set. There is good reason for this because of the compactness and the maze of wires that seem to be connected to everything at once.

Perhaps if we offer the following tips and hints the way might not be hard and after becoming familiarized with the set, its compactness can be appreciated.

To start; completely strip the transmitter of all cover plates. These are the back, top, and sides and come off easily by removing the screws. May we suggest at this point that you get all small wrenches, screw drivers, pliers, socket wrenches and other sundry tools that may be found on the premises for the set is bolted together as solid as the Rock of Gibraltar and it will take quite a variety of tools to break it down. Start at the top by cutting the leads that go to resistor 1196, that's the big filament dropping resistor, and remove it from its holding clamps by taking out the long mounting through the resistor.

Take out the screws that hold the resistor terminal board and lift the assembly off. Turn the transmitter upside down and unsolder those heavy, bare, tinned leads that reach back to the resistor strip that's mounted in the rear of the set. When there are no more solid bus leads to hold the resistor strip go to its ends and remove the two screws that hold each end to its mounts. A long heavy screw

driver is required for the antenna tuner end for reaching through holes in the chassis. When the strip is free it may be manipulated enough to pull it out and back from the chassis. Now start with a sharp knife or razor blade to cut the binding cords that are used to cable the leads together. Don't try to save the pretty cabled appearance of the lead groups, for, too many leads will have to be removed or changed. Cut all the cord that can be reached for the looser the wires are the easier the work will be. Now with the wires loose and the strip pulled back, turn the set right side up and facing front. On the panel behind the oscillator tube compartment are four good sized binder head screws. Remove these and you will find the bakelite submounting panel for the audio input components is now loose. Pull it back from the panel and you can reach the nuts on choke 1146 mountings and those on the capacitor 1147. These formed a filter for using 27 VDC in the carbon mike. Take the two parts off and there will be more room to work.

The article in "Dec. 1946 QST" suggests a speech amplifier stage that can be mounted in this space. This done, put the set back on its top and start removing the Tone-CW-Voice switch 1141. Snip off all leads first to facilitate things. Removing the shaft extension also speeds up the work; next, remove the trimmer and compensator condensers 1103 and 1104. These are beautiful pieces of work but we don't need them for the oscillator is to be changed to a power amplifier. (1104 is a bi-metal supported temperature compensating condenser) also remove the interlock switch 1102 and test key switch 1131 and while we are about it let's remove a few by pass condensers that are not immediately needed and will give us a little more space to work in. These are condensers 1142 (up on the panel that holds the power plugs) and 1150 (attached to the bakelite speech input mounting) and 1180 (on the inside of main resistor strip).

With these parts out we have one deft manipulation to perform before the actual wiring can be begun. In order to get to the audio amplifier tubes socket the modulation transformer must be lifted out of the way. The nuts on the transformer bottom are reached by a socket wrench through the antenna loading section. There is one nut that will give trouble. It is behind the RF switch 1168 in the loading section. After looking over the possibilities of removing the switch this department decided it wasn't worth the effort and so went to work on the nut with a long pin punch from the back of the transmitter. With a little patience the nut can be removed in this fashion. By pulling the resistor strip as far away from the set as possible to give more room, the audio transformer may be jockeyed out of position and pulled back and out of the way of the tube sockets.

Unsolder the leads from the voltmeter to the by-pass condenser and then take out the meter face screws for voltmeters and milliammeter. By slipping the meters partly out of their mounting holes it is much easier to get into the wiring of the sockets.

Now with everything out of the way the re-wiring may proceed. Please note that there are two ground connections to the filament circuits that must be removed. These are copper straps and very solidly soldered to the minus filament terminal on the sockets of the master oscillator and one of the audio tubes.

We will not attempt to give a wire by wire description for there is the practical schematic 2-375 showing location and number of each part.

The audio line which formerly went to the aircraft sidetone circuits may be used to inject the audio driver

power. This winding is tapped so that most any audio amplifier can be matched into it. The tap switch 1179 is adjusted from the front and is on the panel behind the tubes. The wiring for this is shown in diagram 3. The sidetone was taken from a winding on the driver transformer. The taps on this transformer are approximately for the following impedances:

- No. 1— 150 ohms
- No. 2— 400 ohms
- No. 3—2000 ohms
- No. 4—4000 ohms

This is a fair range of taps and should allow the use of practically any type amplifier to be found in the usual ham shack.

For audio drive from a smaller voltage source of power use the jack shown that goes to the primary of the mike transformer 1149.

For the RF input we installed a Jones S-101 type coax socket in the front panel in the hole left from the "test key". A lead was soldered from the contact of this plug to the grid line behind the Parasitic suppressor of the former oscillator. A small transmitter condensor of 50 MMFD was put in place of the tone CW-VOICE switch and connected across the oscillator grid. (This is not shown in the drawing). This was used to aid in resonating the vari-

ous types of RF input tried. For those who do not wish to use the audio driver tube, the socket may be utilized for a plug-in input grid coil. This would work out very nicely for all purposes.

The antenna relay possesses little merit for AC voltage operation. It is simpler to screw down the limit adjustments till relay is closed and leave it in that position, although it may be used by employing dry cell batteries.

For CW operation the antenna relay shorted out resistor 1115 thus lowering the bias on the tube grids. The Hi voltage negative return was across this resistor thereby biasing all tubes to cut-off. This type keying may be preserved by bringing the shorting lead for this resistor to a jack located on the panel.

For bias the best and simplest method are "B" batteries. Modulator tubes require 72-75DC volts, speech amplifier requires 35-40 DC volts. To simplify wiring a biasing controlled as usual by potentiometers provided in the original.

In order to use the tuning units supplied it will be necessary to change or modify them somewhat. As they are now there will be insufficient driving voltage to the final grid and the taps on the coil must be changed. We suggest the owner look up a December 1946 copy of QST for reference to coil changes.



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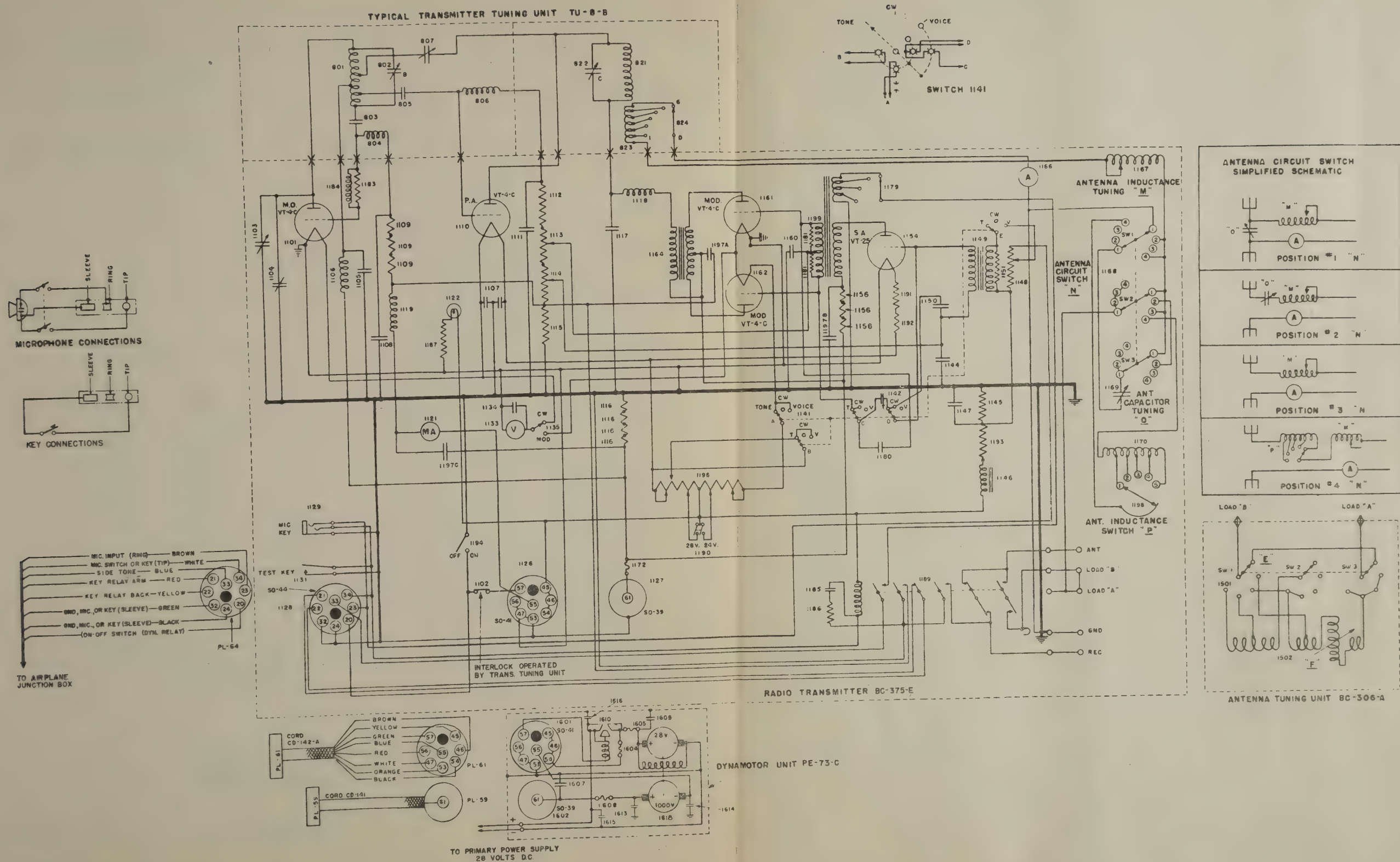


Figure 1-375

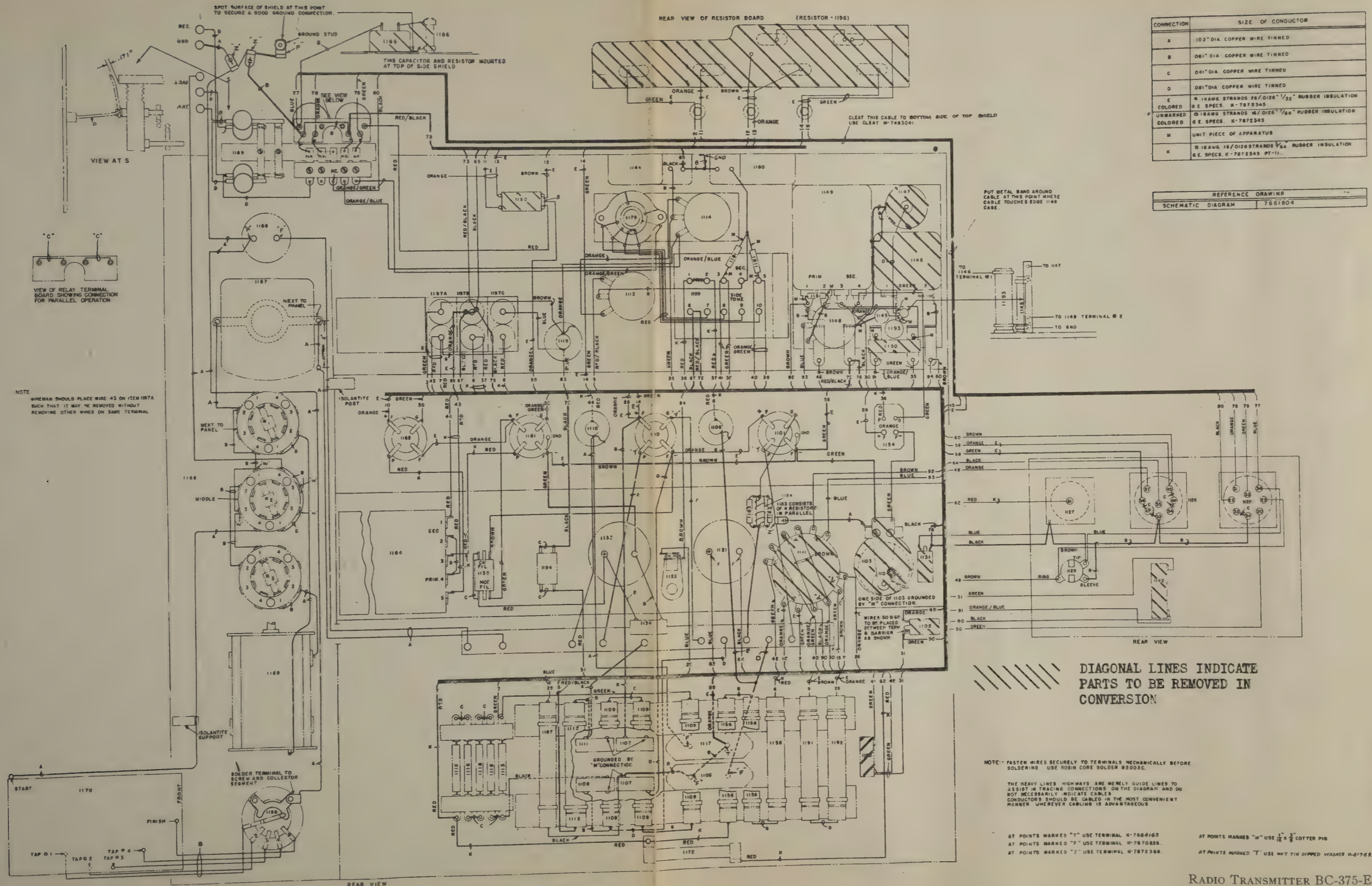


FIGURE 2-375

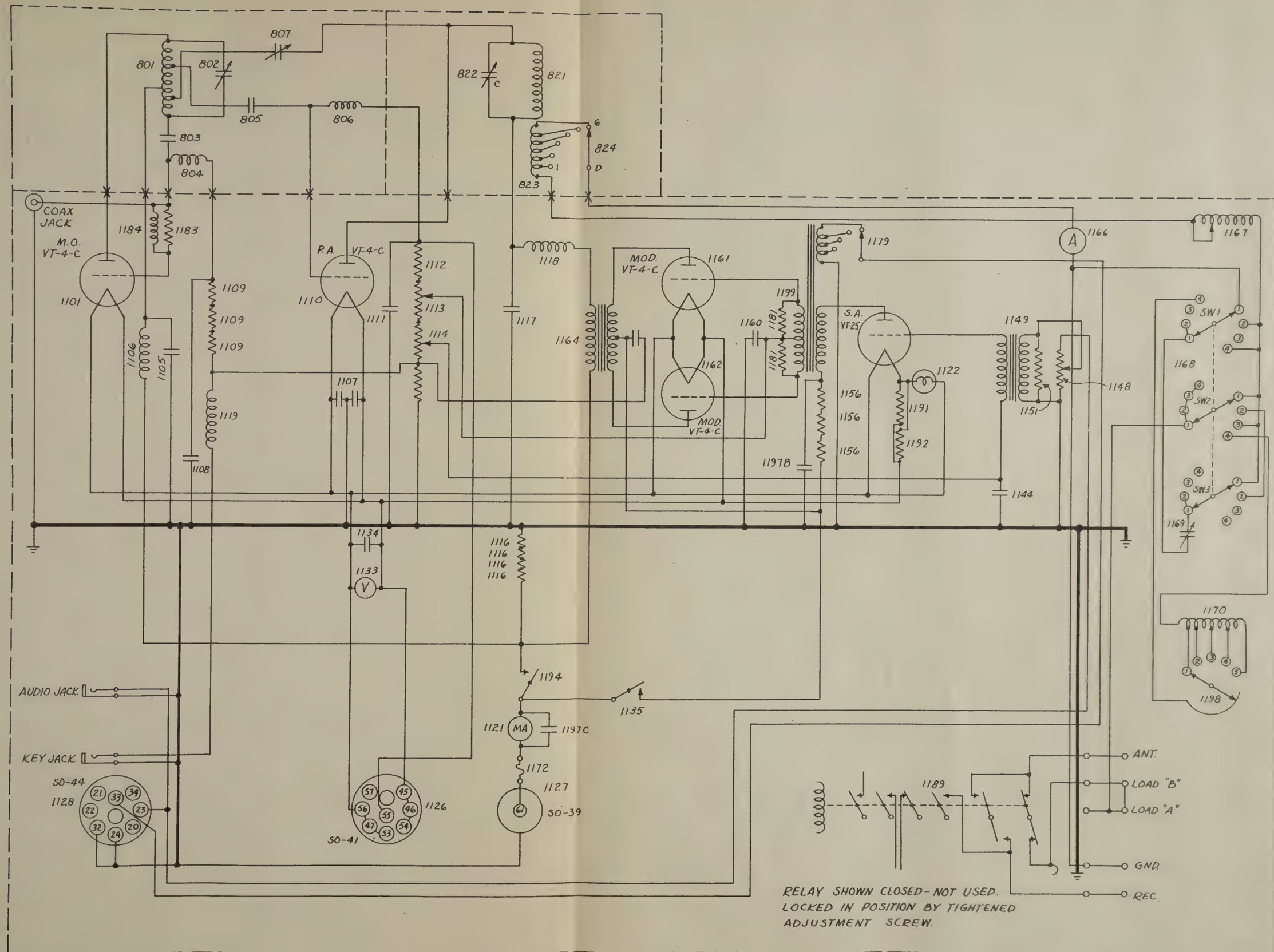


FIG. 3-375

LIST OF DRAWINGS FOR SCR-522

- Figure 1 —Shows connections for using 522 in original wiring for 27 VDC or with Electric motor driving.
- Figure 2 —Same as Figure 1
- Figure 3 A-B—Shows steps in rebuilding 522 band changing motor.
- Figure 2-A —Gives radii and shows how cuts are made in genemotor case to allow reversed genemotor to protrude from one end.
- Figure 4 —A practical wiring diagram for FT-224 showing new connections for use of 522 with 110V AC power pack.
- Figure 5 New locations of parts for converting FT-224 for 110 AC operation.
- Figure 6 —Self explanatory drawings of field windings on genemotor and lead switching for paralleling the fields for 12 volt operation.
- Figure 7 —Original schematic of BC-625 transmitter.
- Figure 8 —Original schematic of BC-624 receiver.
- Figure 9 —Complete original, overall schematic of transmitter-receiver power supply and wiring harness.

SCR-522

Many articles have appeared, to date, in different radio publications offering various means of converting the SCR-522 VHF set. These articles are good and we have tried them, but there is one thought we should like to put forth that no previous article has mentioned. This is, simply use the SCR-522 in its original case and not bother to separate transmitter from receiver and build separator panels, chassis and power supplies. We even find it convenient to leave on the band changing equipment and thus utilize a quick change of bands for the transmitter.

With the receiver and transmitter left in the case and with the rack FT-224 left on to connect to the terminals of them it is only necessary to incorporate the few simple changes given in the following drawings and script and we have a table mount VHF that is small and very convenient.

To convert the SCR-522 for power pack operation and retain the equipment case we need only to modify the rack FT-224. The following plans and descriptions will give a fair idea of how this is done. When the changes are completed a Prestwood panel is installed over the face of the rack with cut-outs over the transmitter crystal sockets and tuning dials, an O-1 millimeter mounted in the panel in the space left by cutting away the body of the ratchet motor. Shaft extensions are brought out to knobs for the receiver tuning controls and gain controls for Receiver and Transmitter. The metering switch of the transmitter is also extended to the panel.

RACK CHANGES FOR 522

1. Open the two hinged covers on the set, by turning with a screw driver, the four DZUS fastens, now remove the four hinge bolts that are at the corners of the frame and lift off the hinge covers. BC-624 and BC-625 are attached to FT-224 (the frame work that holds the two together) by four each, shoulder studs. These are easily found for they are painted red. Before loosening these studs grasp the ratchet motor, which drives the band changing mechanism, and by alternately squeezing and releasing the armature (the movable part of the motor),

identified by the two coil springs attached to one end. Force the mechanism through one cycle, far enough to bring all plungers back to neutral. Now take out the red studs and gently pry the rack FT-224 off the transmitter and receiver. This can be accomplished by slipping a screw driver under the rack and gently prying it up.

2. Lay out FT-224 and take out the two end screws and the four screws around each plug of the center cover and the plate may be lifted off.

3. With wire cutters, snip the leads to the two power and control plugs and remove same, snip leads to the ratchet motors and take out by removing four screws on the back of the rack and on the top, attached to the plunger frame. Next to go are the three relays 411-1, 411-2 and 412 (they have numbers printed beside each one on the frame) the screws holding these are easily found. Next to come out are condensers 401, 402 and switch 426. We also remove antenna plug 416 and its mounting base. The antenna plugs which connect to the transmission and receiver are a part of this assembly and must be put back. Now cut out all the original wiring with the exception of the braid covered leads connected to pins 1 and 2 off transmission plug 418-1. The net result of our labors thus far is a chassis or frame stripped of all it held with the exception of three plugs and the tuning slides.

4. Drill a $\frac{3}{4}$ " hole in the center of the right hand handle grip pocket. When drilled (or routed out with a rat tail file) slip the antenna connector through the hole and with a scribe mark the 4 screw holes and drill with a $\frac{1}{8}$ " drill. Fasten the antenna connector screws before replacing the transmitter receiver plug strip for the bottom screws are impossible to reach if not put in first. Next we install the power plug. This may be most any type of plug or strip which will fit into the width of the side of FT-224. We could of course use the original plug in the original place but this would spoil the appearance and be in the way in front of our panel. There are many types of plugs available. We used a Jones plug of 6 contacts because it was small and flat sided. A terminal strip on the outside would do just as well. At any rate, it is suggested that it be installed on the left side of the rack as close to the bottom as possible without interfering with transmitter plug 418-1.

Cut out the metal bracing strip in the upper left hand corner as marked in 192 as it will be in the way of the shaft extension of the audio control beneath it. As the band changing ratchet motor will not function on AC we must modify this useful piece of equipment. First remove all the screws and bolts until we have all parts removed from the frame. Now with a hacksaw cut the frame in three places as shown in **Figure 3A**, with cutting done we tap out the shaft hole in the ratchet with an 8-32 tap. This allows one of the red painted studs that formerly held rack FT-224 to transmitter-receiver assembly to be screwed into ratchet wheel shaft thus giving us a shaft to attach a knob to. Cut $\frac{3}{4}$ " from the screw end of the small shaft that formerly went through the ratchet wheel and spread it slightly by tapping with a hammer until it is a force fit into the bottom end of the ratchet wheel shaft. Be sure to allow it to protrude enough to go into the hole punched for it in FT-224 for it serves as a guide pin in aligning the ratchet motor frame. We now have only to ream out the top shaft hole in the motor frame to 5-16" and by reassembling the band control is finished as shown in **Figure 3 B**.

In the left hand grip pocket drill two $\frac{3}{8}$ " equally spaced holes to receive mike and headset jacks.

522 RECEIVER

The receiver as it stands is crystal controlled and therefore is bound to whatever frequencies the operator possesses crystals for.

This may be rectified in a number of ways. The first suggestion tried by us works out very well but has bad feature of high cost. Four Bliley VFI variable frequency crystals were obtained and plugged into the receiver. Fair coverage was obtained in the two meter band. Tuning is sharp but clumsy because of the complex controls, which made it necessary to check the receiver through the range with a signal generator before using it in order to log the dial positions.

Changing the crystal circuit to a self exciting oscillator did not cure the headaches of tuning, but by using a very small tuning capacity nice coverage over the 2 meter band was obtained by fixing the RF and Harmonic generator first and then tuning by the ex-crystal stage. complete revision of the RF end or the 522 receiver would of course be the ideal solution but to us, and to most others, the challenge was to evolve a usable circuit from the original. Of all the ideas advanced toward this end we find that the best was offered by Ray Frank, Amateur Editor, Radio News in the October 1946 issue of that magazine. This article gives the necessary pertinent data for changing the harmonic generator to an oscillator and reduces the set controls to two knobs. That system has worked out best of all. The control knob of the harmonic generator must be geared 40 or 50 to 1 in order to keep the tuning from being critical. Also the RF line up. To most users the critical point was not noticed in the RF stages as the sets are used for local rag-chewing but the RF is capable of good gain and sharp tuning when properly aligned.

In an effort to spread the 2 meter band across a wider portion of the dial or get away from the high ratio tuning dial and critical alignment of stages the old device of inserting a series condenser in the tuning circuit was tried. National type M-30 trimmer condensers were inserted between the coil and tuning condenser, these have a maximum capacity of 30 MMF. This effectively reduces the capacity of the tuning condensers to the point where the band is spread out appreciably.

TRANSMITTER

One good use for the BC-625 transmitter that has been overlooked by many amateurs is 6 meter band operation. The plate circuit of the oscillator is tuned to the second harmonic of the crystal, this is fed to the first harmonic amplifier whose plate circuit is resonated to the 3rd multiple of the 2nd harmonic or the 6th crystal harmonic. Using a 8.5833 k. c. crystal in the oscillator puts 51.5 m. c. to the grids of the 2nd harmonic amplifier it remains only to wind up new tank coils for the second harmonic amplifier and final tank.

DYNAMOTOR

The SCR-522 is designed to operate from two D. C. sources, 14 and 27 volts. There is a separate motor generator built to operate from each of these voltages, PE-94-A is the 27 volt unit and PE-98-A for 14 volts. PE-98-A for 14 volt operation are scarce for few airplanes had a 14 volt battery system. Most SCR-522 now available come equipped with PE-94-A. There is no difference in the transmitter and receiver for they are in all cases wired for 12 volts filament and relay control. Each genemotor has a low voltage commutator delivering 12 volts for trans-

mitter-receiver. In some instances 12 volt battery operation may be desired and only a PE-94-A is available. By making a number of changes in the field windings of the genemotors and combining the motor action of the 27 volt motor end together and by using battery source for filaments and relays, operation of SCR-522 may be used. This is not satisfactory from a perfection point of view for we lose ampere turns in the field and there is no way to reduce the number of turns or increase the wire size of the motor winding of the armature. New field windings may be wound up and successfully used but this writing will not attempt this for it is doubted that many experimentors will be interested. The following diagrams are given for those who may wish to have on hand an emergency hookup that can be done in a short while and requires nothing more than a few solder connections.

In using the SCR-522 we must have a power supply. The one that came with it originally was designed to operate with a D. C. input of 27 VDC at a current of 13 amperes. To most people this is not an ideal set up for 27 volt storage batteries are not generally found around the average household. However, close examination of the power genemotor supplied with the SCR-522 will reveal that it may be used as a straight generator provided: Some external mechanical means are used to furnish the rotating power. Tests in actual operation have proven that $\frac{1}{4}$ horsepower is needed for the job. The generator is already equipped with $\frac{1}{2}$ inch shaft to fit a standard "V" pulley to and by turning the generator end for end in its mounting the pulley will protrude enough to attach a belt to it.

COLONIAL MODEL

Take out the screws on both ends of the cover. You will find the dynamotor held in position by a steel compression strap. On the low voltage end of the dynamotor you will find three large leads colored green, blue and yellow. On the high voltage end there are three smaller leads colored red, orange and green with a braided ground strap attached to the genemotor case.

The large wires are: yellow, positive 27 volts to field and motor winding, blue, positive 27 volts from carbon file regulators to shunt control field of genemotor. The smaller wires are: red, positive 300 volts plate supply; orange, minus 150 volts bias voltage for transmitter; green (brown, black, white according to model) is 14.5 volts positive for filament and relay supply to SCR-522.

1. Remove the wires from the high and low voltage connections and unscrew the connecting bolt from the compression band that holds the genemotor.

2. Lift the dynamotor from the case and remove the end bell covers from both ends. The low voltage end cover is the shorter of the two and is held by two screws in the end case. The longer cover is held by four screws arranged around the circumference of the dynamotor case.

3. You will find a blower fan on the armature shaft at the high voltage end of the dynamotor. This is held by two allen set screws. Remove the fan.

4. With a circle cutter make a one-and-one half ($1\frac{1}{2}$) inch hole in the end center of the shorter end bell cover.

5. Remove all four screws from the bearing cover at the high voltage end of the dynamotor and put the short end bell cover over this end. Use two screws only to hold the bearing cover plate and end bell cover.

6. The longer end bell cover may be left off for better cooling or slipped on and held by a bank of masking or

adhesive tape, or, better still, drill and tap the low voltage end bell for 6-32 screws so the cover will attach as it did when on the opposite end.

7. As the dynamotor will be placed back in the chassis in a reversed position to allow the shaft end to protrude, the case must be altered slightly to allow for this. Assume that the right hand end of the chassis is when viewed facing the unit with both plugs toward you, with a pair of tin snips cut out the steel mesh screen in the chassis cover on the right hand side also the bottom and back side supports for the screen. Now a small curved section in the top, bottom and back of the right hand end must be removed to allow room for the dynamotor end bell cover to protrude. We do this the easy way by placing the dynamotor in the chassis with the shaft flush with the right end then inscribe with a divider compass a $2\frac{1}{4}$ " radius and cut out the sections of arc that were within the radius. **Figure 2** gives the idea.

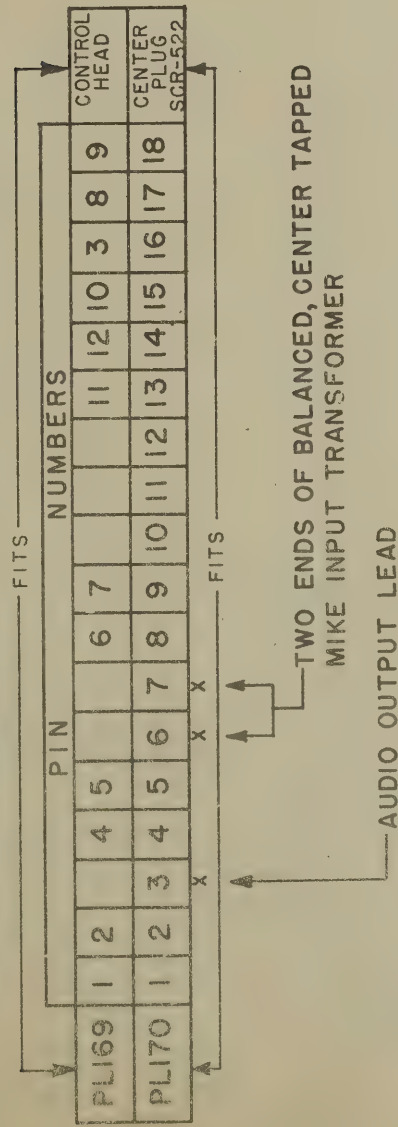
8. Now the dynamotor may be put back in its cradle and strapped down. The leads are replaced in this manner. Large yellow lead in its original place on top of 2 of the

start-stop relay. Large green lead under the small bolt that held the braid grounding strap. Remove the short red lead from taps 1 and 3 off the start-stop relay and low volts input filter and using taps 1 and-or, 3 as a terminal place the large blue lead and the smaller blue lead coming from the carbon file regulator together. Replace the red, orange and brown leads going from the high voltage parts of the genemotor in their original positions—it may be necessary to cut a new feed through hole in the firewall separating the generator from the filter compartments due to short length of large leads.

9. We now have a genemotor that will supply the high and low voltages required by the SCR-522. It may be driven by an electric motor or gas engine. The usual $\frac{1}{4}$ horsepower motor will drive this generator if not overloaded. Reading from the manufacturers plate on the dynamotor we find that it originally ran at 4700 RPM. The closer to that speed the generator is run the better regulation is obtained by the carbon file regulator. However, by using a $\frac{1}{4}$ HP motor with a 5" "V" pulley and 2" "V" pulley on the generator sufficient voltage is obtained for good operation.

SOCKET CONNECTIONS

CONTROL HEAD TO TRANSMITTER-RECEIVER

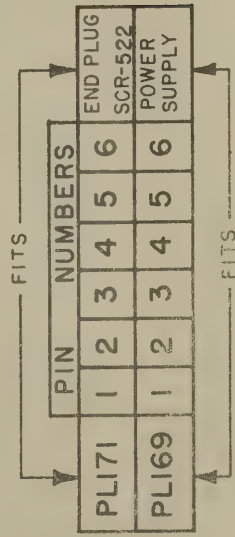


NOTE:
ALL PLUG PINS IN UPPER BOXES ARE CONNECTED
TO PINS IN LOWER BOXES. AS AN EXAMPLE
PIN NO. 7 OF PL169 IS CONNECTED TO PIN NO. 9
OF PL170.

FIGURE 1

SOCKET CONNECTIONS

POWER SUPPLY TO TRANSMITTER-RECEIVER



NOTE:
THESE CONNECTIONS FOR USE OF SCR-522
WITH SET UNCHANGED AS TO CIRCUIT.

FIGURE 2-522

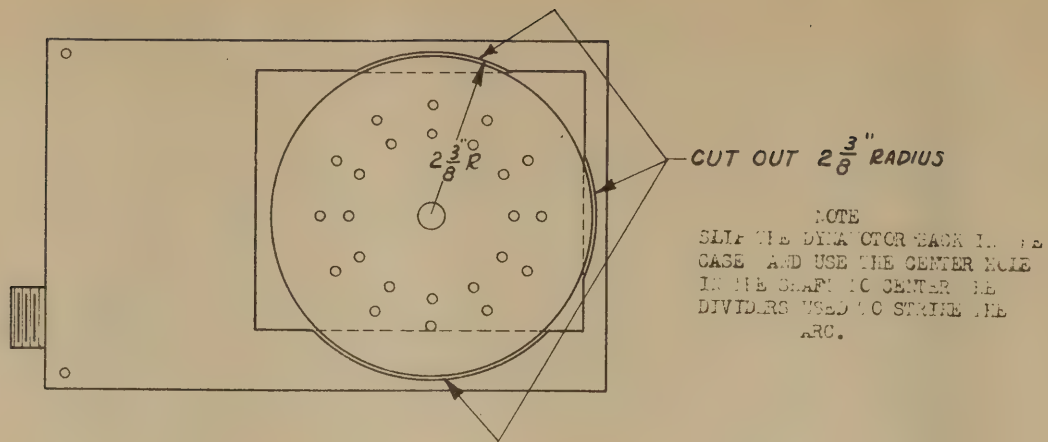


FIGURE 2 A 522

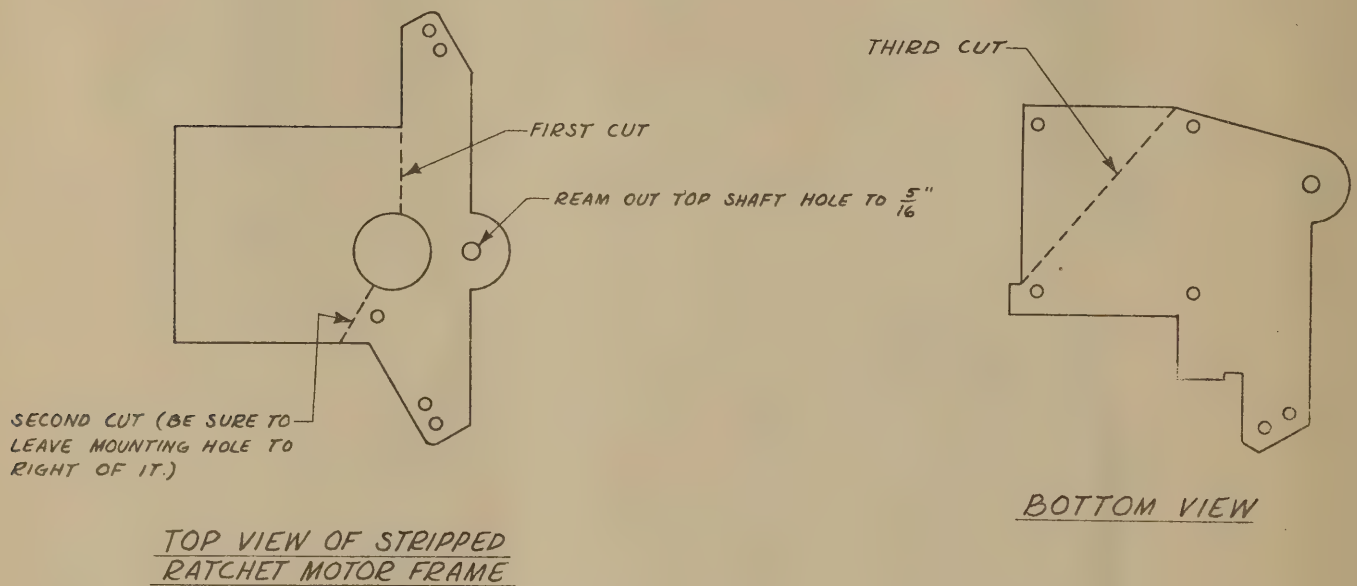


FIGURE 3A

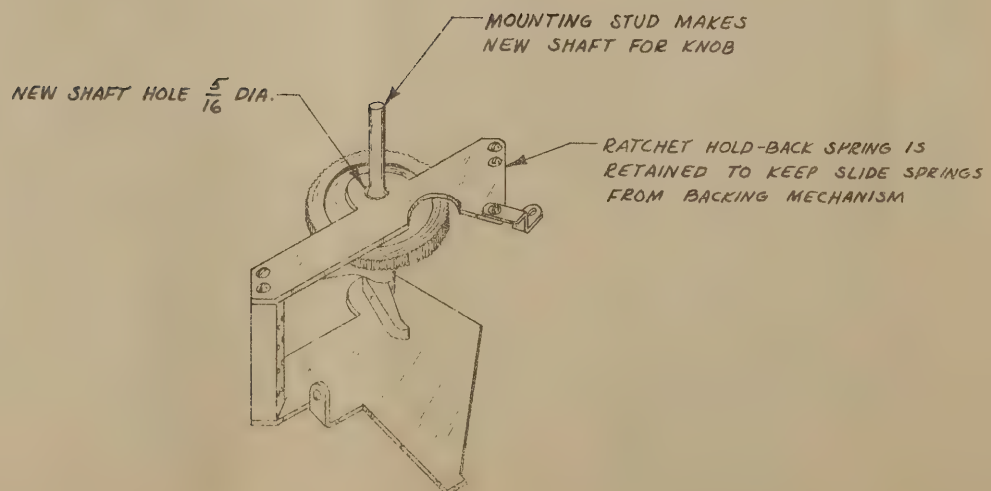


FIGURE 3B-522

CUT TO ALLOW CONTROL SHAFT
TO REACH PANEL

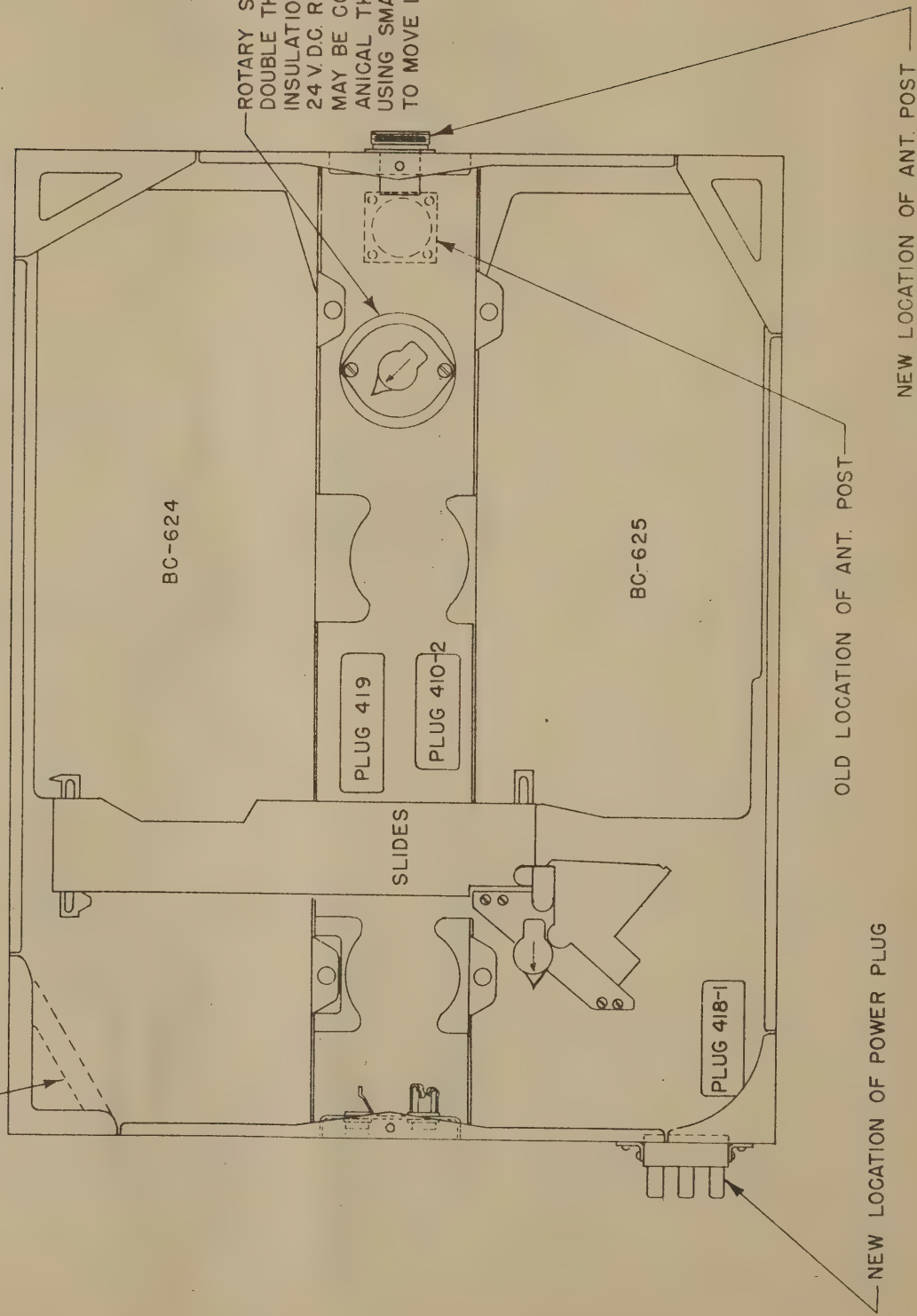


FIGURE 5-522

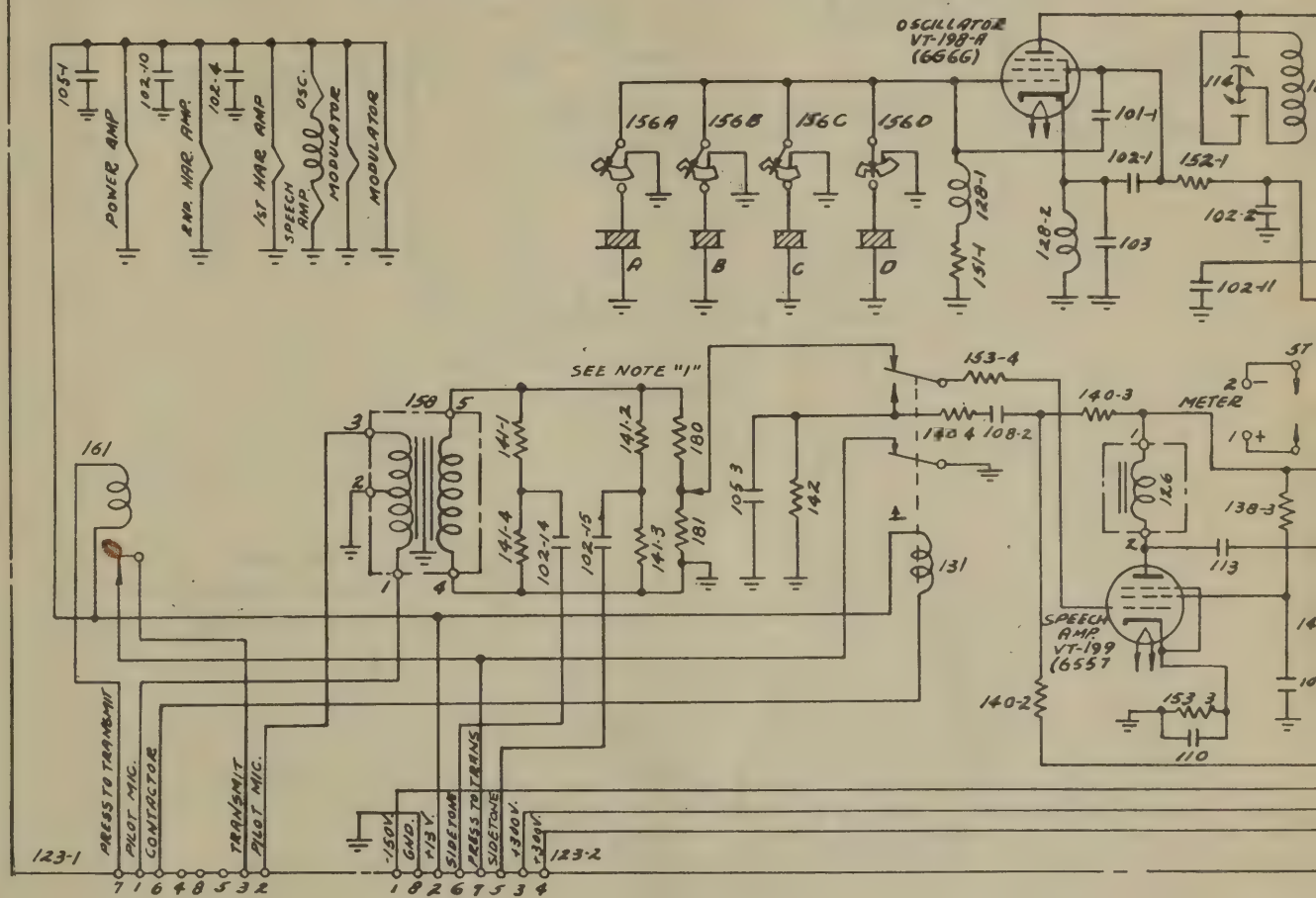


FIGURE 7-

CUT TO ALLOW CONTROL SHAFT
TO REACH PANEL

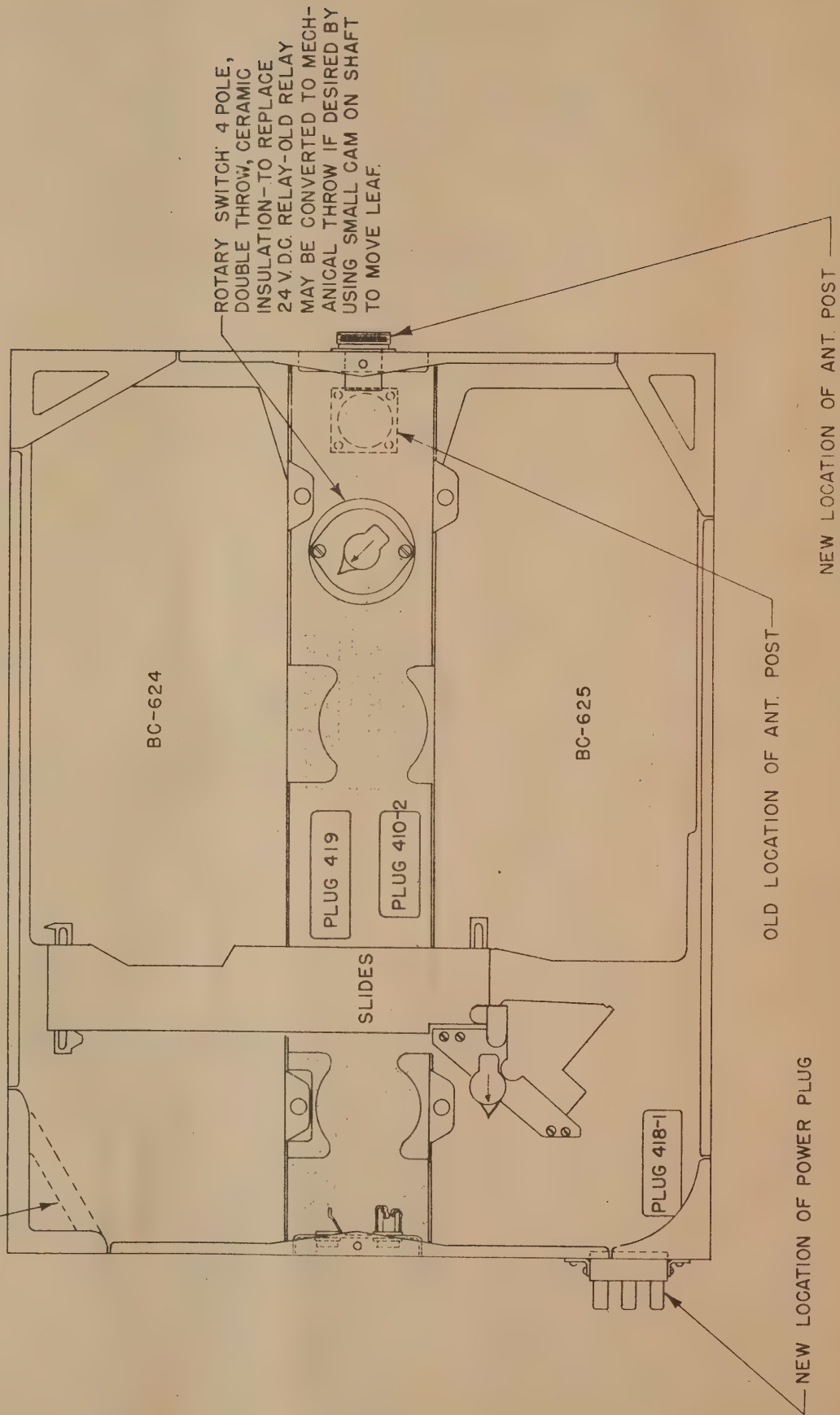


FIGURE 5-522

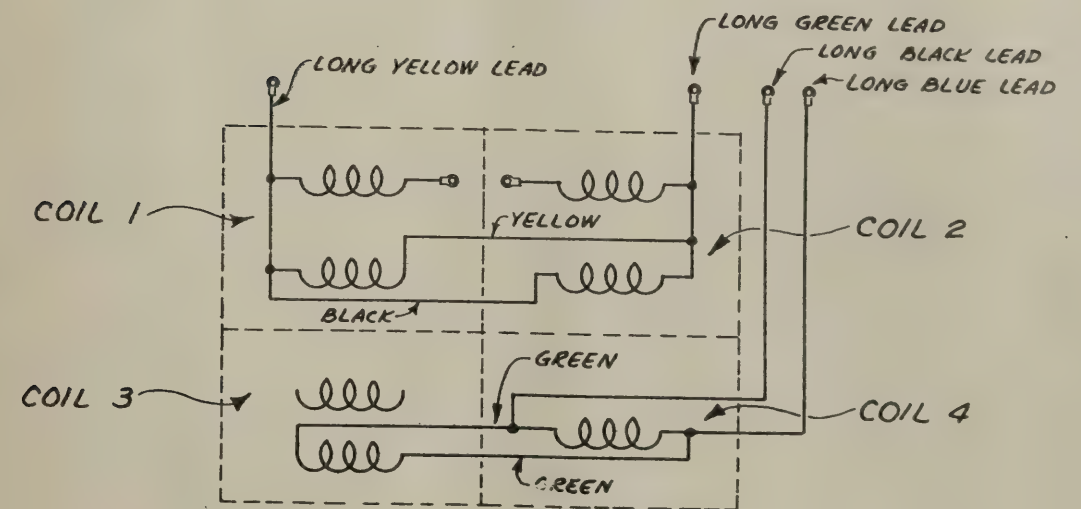
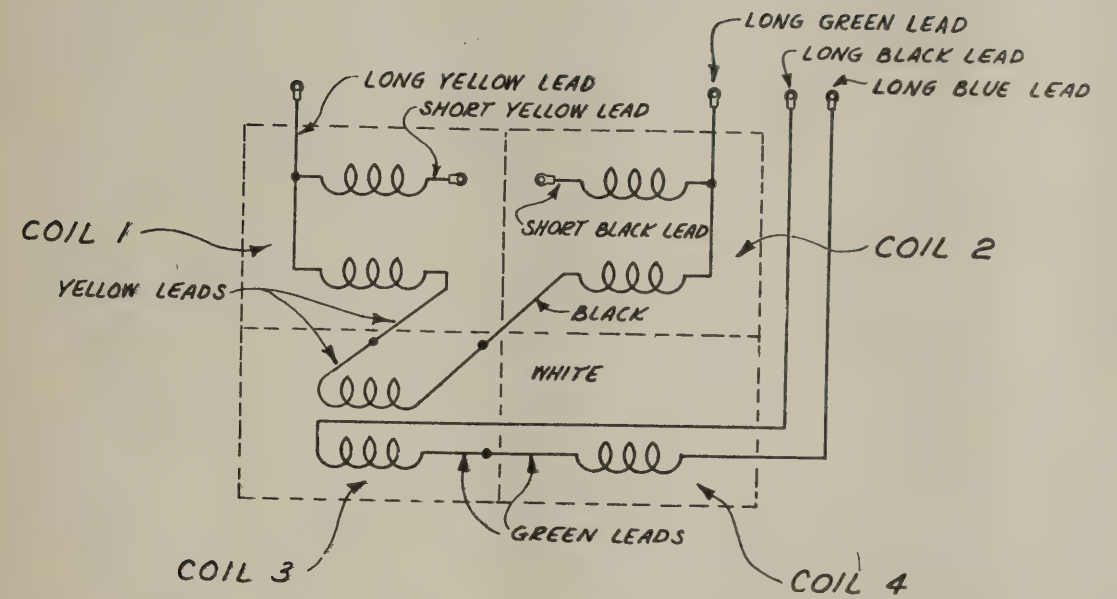
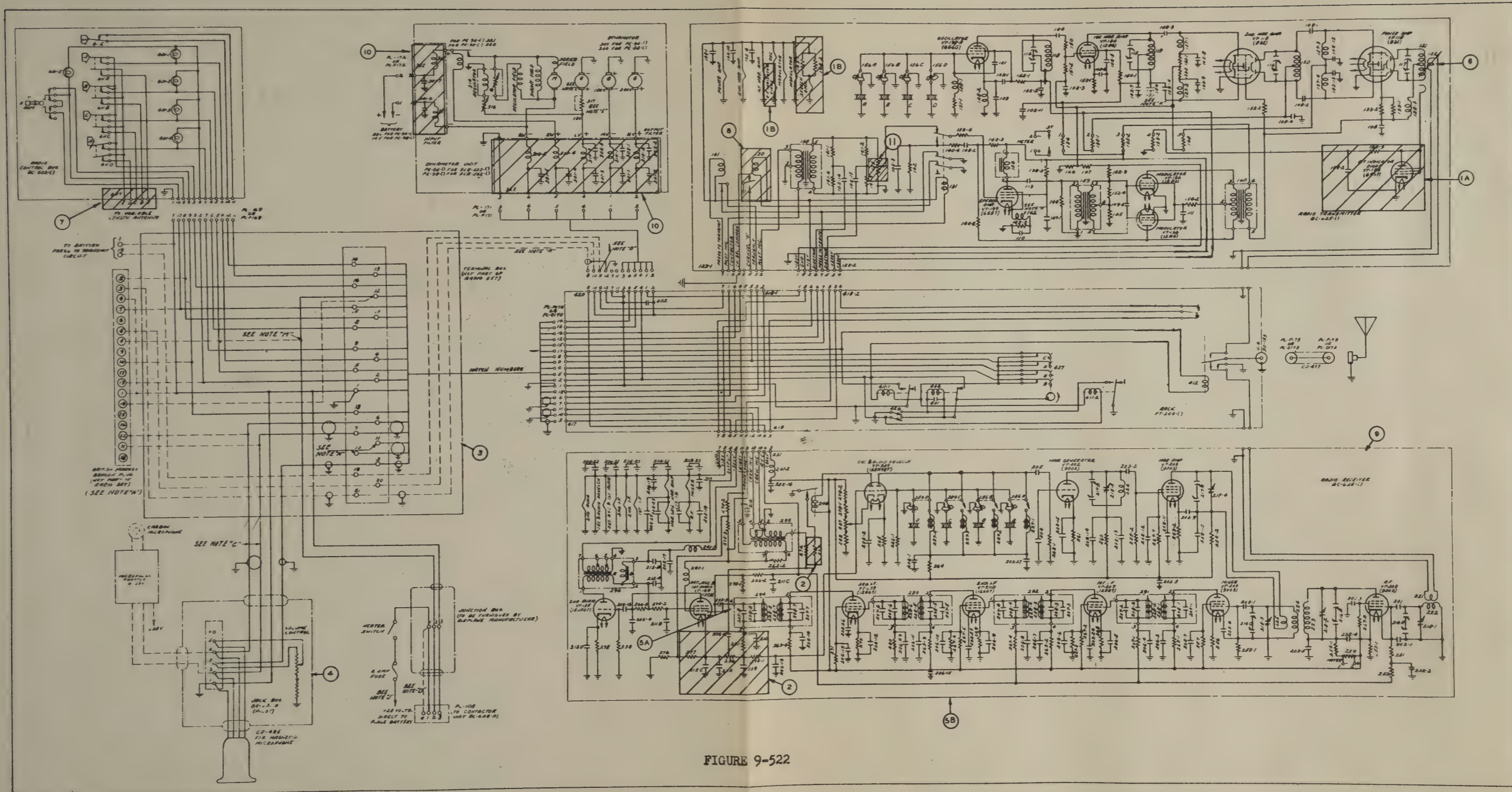


FIGURE 6-522



CRYSTAL FREQUENCY CHART

Carrier f	Crystals	
	Receive	Trans.
100.08	8007.27	5560.0
100.26	8023.64	5570.0
100.44	8040.00	5580.0
100.62	8056.36	5590.0
100.80	8072.73	5600.0
100.98	8089.09	5610.0
101.16	8105.45	5620.0
101.34	8121.82	5630.0
101.52	8138.18	5640.0
101.70	8154.55	5650.0
101.88	8170.91	5660.0
102.06	8187.27	5670.0
102.24	8203.64	5680.0
102.42	8220.00	5690.0
102.60	8236.36	5700.0
102.78	8252.73	5710.0
102.96	8269.09	5720.0
103.14	8285.45	5730.0
103.32	8301.82	5740.0
103.50	8318.18	5750.0
103.68	8334.55	5760.0
103.86	8350.91	5770.0
104.04	8367.27	5780.0
104.22	8383.64	5790.0
104.40	8400.00	5800.0
104.58	8416.36	5810.0
104.76	8432.73	5820.0
104.94	8449.09	5830.0
105.12	8465.45	5840.0
105.30	8481.82	5850.0
105.48	8498.18	5860.0
105.66	8514.55	5870.0

F M
Broadcast

Carrier f	Crystals	
	Receive	Trans.
105.84	8530.91	5880.0
106.02	8547.27	5890.0
106.20	8563.64	5900.0
106.38	8580.00	5910.0
Facsimile 106.56	8596.36	5920.0
106.74	8612.73	5930.0
106.92	8629.09	5940.0
107.10	8645.45	5950.0
107.28	8661.82	5960.0
107.46	8678.18	5970.0
107.64	8694.55	5980.0
107.82	8710.91	5990.0
108.00	8000.00	6000.0
108.18	8015.00	6010.0
108.36	8030.00	6020.0
108.54	8045.00	6030.0
108.72	8060.00	6040.0
108.90	8075.00	6050.0
Air 109.08	8090.00	6060.0
Navigation 109.26	8105.00	6070.0
(Localizer) 109.44	8120.00	6080.0
109.62	8135.00	6090.0
109.80	8150.00	6100.0
109.98	8165.00	6110.0
110.16	8180.00	6120.0
110.34	8195.00	6130.0
110.52	8210.00	6140.0
110.70	8225.00	6150.0
110.88	8240.00	6160.0
111.06	8255.00	6170.0
111.24	8270.00	6180.0
111.42	8285.00	6190.0
111.60	8300.00	6200.0
111.78	8315.00	6210.0
111.96	8330.00	6220.0
112.14	8345.00	6230.0
112.32	8360.00	6240.0
112.50	8375.00	6250.0
Air 112.68	8390.00	6260.0
Navigation 112.86	8405.00	6270.0
(Range) 113.04	8420.00	6280.0
113.22	8435.00	6290.0
113.40	8450.00	6300.0
113.58	8465.00	6310.0
113.76	8480.00	6320.0


CRYSTAL FREQUENCY CHART

	Carrier f	Crystals			Carrier f	Crystals	
		Receive	Trans.			Receive	Trans.
	113.94	8495.00	6330.0		121.86	8450.77	6770.0
	114.12	8510.00	6340.0		122.04	8464.62	6780.0
	114.30	8525.00	6350.0		122.22	8478.46	6790.0
	114.48	8540.00	6360.0		122.40	8492.31	6800.0
	114.66	8555.00	6370.0		122.58	8506.15	6810.0
	114.84	8570.00	6380.0		122.76	8520.00	6820.0
	115.02	8585.00	6390.0		122.94	8533.85	6830.0
	115.20	8600.00	6400.0		123.12	8547.69	6840.0
	115.38	8615.00	6410.0	Aeronautical	123.30	8561.54	6850.0
	115.56	8630.00	6420.0	(Mobile)	123.48	8575.38	6860.0
	115.74	8645.00	6430.0		123.66	8589.23	6870.0
Air	115.92	8660.00	6440.0		123.84	8603.08	6880.0
Navigation	116.10	8007.69	6450.0		124.02	8001.43	6890.0
	116.28	8021.54	6460.0		124.20	8014.29	6900.0
	116.46	8035.38	6470.0		124.38	8027.14	6910.0
	116.64	8049.23	6480.0		124.56	8040.00	6920.0
	116.82	8063.08	6490.0		124.74	8052.86	6930.0
	117.00	8076.92	6500.0		124.92	8065.71	6940.0
	117.18	8090.77	6510.0		125.10	8078.57	6950.0
	117.36	8104.62	6520.0		125.28	8091.43	6960.0
	117.54	8118.46	6530.0		125.46	8104.29	6970.0
	117.72	8132.31	6540.0		125.64	8117.14	6980.0
	117.90	8146.15	6550.0		125.82	8130.00	6990.0
	118.08	8160.00	6560.0		126.00	8142.86	7000.0
	118.26	8173.85	6570.0		126.18	8155.71	7010.0
	118.44	8187.69	6580.0		126.36	8168.57	7020.0
	118.62	8201.54	6590.0		126.54	8181.43	7030.0
Aeronautical	118.80	8215.38	6600.0		126.72	8194.29	7040.0
(Airport)	118.98	8229.23	6610.0		126.90	8207.14	7050.0
	119.16	8243.08	6620.0		127.08	8220.00	7060.0
	119.34	8256.92	6630.0		127.26	8232.86	7070.0
	119.52	8270.77	6640.0		127.44	8245.71	7080.0
	119.70	8284.62	6650.0		127.62	8258.57	7090.0
	119.88	8298.46	6660.0		127.80	8271.43	7100.0
	120.06	8312.31	6670.0		127.98	8284.29	7110.0
	120.24	8326.15	6680.0		128.16	8297.14	7120.0
	120.42	8340.00	6690.0		128.34	8310.00	7130.0
	120.60	8353.85	6700.0		128.52	8322.86	7140.0
	120.78	8367.69	6710.0		128.70	8335.71	7150.0
	120.96	8381.54	6720.0		128.88	8348.57	7160.0
	121.14	8395.38	6730.0		129.06	8361.43	7170.0
	121.32	8409.23	6740.0		129.24	8374.29	7180.0
	121.50	8423.08	6750.0		129.42	8387.14	7190.0
	121.68	8436.92	6760.0		129.60	8400.00	7200.0

CRYSTAL FREQUENCY CHART

	Carrier f	Crystals			Carrier f	Crystals	
		Receive	Trans.			Receive	Trans.
	129.78	8412.86	7210.0		137.70	8380.00	7650.0
	129.96	8425.71	7220.0		137.88	8392.00	7660.0
	130.14	8438.57	7230.0		138.06	8404.00	7670.0
	130.32	8451.43	7240.0		138.24	8416.00	7680.0
	130.50	8464.29	7250.0		138.42	8428.00*	7690.0
	130.68	8477.14	7260.0		138.60	8440.00	7700.0
	130.86	8490.00	7270.0		138.78	8452.00	7710.0
	131.04	8502.86	7280.0		138.96	8464.00	7720.0
	131.22	8515.71	7290.0		139.14	8476.00	7730.0
	131.40	8528.57	7300.0		139.32	8488.00	7740.0
	131.58	8541.43	7310.0		139.50	8500.00	7750.0
	131.76	8554.29	7320.0		139.68	8512.00	7760.0
	131.94	8567.14	7330.0		139.86	8524.00	7770.0
	132.12	8008.00	7340.0		140.04	8002.50	7780.0
	132.30	8020.00	7350.0		140.22	8013.75	7790.0
	132.48	8032.00	7360.0		140.40	8025.00	7800.0
	132.66	8044.00	7370.0		140.58	8036.25	7810.0
	132.84	8056.00	7380.0		140.76	8047.50	7820.0
	133.02	8068.00	7390.0		140.94	8058.75	7830.0
	133.20	8080.00	7400.0		141.12	8070.00	7840.0
	133.38	8092.00	7410.0		141.30	8081.25	7850.0
	133.56	8104.00	7420.0		141.48	8092.50	7860.0
	133.74	8116.00	7430.0		141.66	8103.75	7870.0
	133.92	8128.00	7440.0		141.84	8115.00	7880.0
	134.10	8140.00	7450.0		142.02	8126.25	7890.0
Aeronautical (Fixed)	134.28	8152.00	7460.0		142.20	8137.50	7900.0
	134.46	8164.00	7470.0		142.38	8148.75	7910.0
(Government)	134.64	8176.00	7480.0		142.56	8160.00	7920.0
	134.82	8188.00	7490.0		142.74	8171.25	7930.0
	135.00	8200.00	7500.0		142.92	8182.50	7940.0
	135.18	8212.00	7510.0		143.10	8193.75	7950.0
	135.36	8224.00	7520.0		143.28	8205.00	7960.0
	135.54	8236.00	7530.0		143.46	8216.25	7970.0
	135.72	8248.00	7540.0		143.64	8227.50	7980.0
	135.90	8260.00	7550.0		143.82	8238.75	7990.0
	136.08	8272.00	7560.0		144.00	8250.00	8000.0
	136.26	8284.00	7570.0		144.18	8261.25	8010.0
	136.44	8296.00	7580.0		144.36	8272.50	8020.0
	136.62	8308.00	7590.0		144.54	8283.75	8030.0
	136.80	8320.00	7600.0		144.72	8295.00	8040.0
	136.98	8332.00	7610.0	Amateur	144.90	8306.25	8050.0
	137.16	8344.00	7620.0		145.08	8317.50	8060.0
	137.34	8356.00	7630.0		145.26	8328.75	8070.0
	137.52	8368.00	7640.0		145.44	8340.00	8080.0

CRYSTAL FREQUENCY CHART

	Carrier f	Crystals			Carrier f	Crystals		
		Receive	Trans.			Receive	Trans.	
Amateur	145.62	8351.25	8090.0		150.84	8167.06	8380.0	
	145.80	8362.50	8100.0		151.02	8177.65	8390.0	
	145.98	8373.75	8110.0		151.20	8188.24	8400.0	
	146.16	8385.00	8120.0		151.38	8198.82	8410.0	
	146.34	8396.25	8130.0		151.56	8209.41	8420.0	
	146.52	8407.50	8140.0		151.74	8220.00	8430.0	
	146.70	8418.75	8150.0		151.92	8230.59	8440.0	
	146.88	8430.00	8160.0		152.10	8241.18	8450.0	
	147.06	8441.25	8170.0		152.28	8251.76	8460.0	
	147.24	8452.50	8180.0		152.46	8262.35	8470.0	
	147.42	8463.75	8190.0		152.64	8272.94	8480.0	
	147.60	8475.00	8200.0		Railroad.	152.82	8283.53	8490.0
	147.78	8486.25	8210.0		Press Relay.	153.00	8294.12	8500.0
	147.96	8497.50	8220.0		Urban	153.18	8304.71	8510.0
	148.14	8008.24	8230.0		Telephone.	153.36	8315.29	8520.0
Government (Fixed) (Aero)	148.32	8018.82	8240.0	Police.	153.54	8325.88	8530.0	
	148.50	8029.41	8250.0	Fire	153.72	8336.47	8540.0	
	148.68	8040.00	8260.0	Maritime	153.90	8347.06	8550.0	
	148.86	8050.59	8270.0	Geophysical	154.08	8357.65	8560.0	
	149.04	8061.18	8280.0	Experi- mental.	154.26	8368.24	8570.0	
	149.22	8071.76	8290.0		154.44	8378.82	8580.0	
	149.40	8082.35	8300.0		154.62	8389.41	8590.0	
	149.58	8092.94	8310.0		154.80	8400.00	8600.0	
	149.76	8103.53	8320.0		154.98	8410.59	8610.0	
	149.94	8114.12	8330.0		155.16	8421.18	8620.0	
	150.12	8124.71	8340.0		155.34	8431.76	8630.0	
	150.30	8135.29	8350.0		155.52	8442.35	8640.0	
	150.48	8145.88	8360.0		155.70	8452.94	8650.0	
	150.66	8156.47	8370.0		155.88	8463.53	8660.0	

MODIFICATIONS OF MAJOR ASSEMBLIES OF RADIO SET SCR-522-A

Previous Model Number	Latest Model Number	Modification
Radio Transmitter BC-625-A	Radio Transmitter BC-625-A (modified)	1. R.F. indicator diode removed; filament circuits rewired.
Radio Transmitter BC-625-A	Radio Transmitter BC-625-AM	1. Slow release relay, 130, removed.
Radio Receiver BC-624-A	Radio Receiver BC-624-AM	1. Field modified to include tube JAN-12H6, noise suppressor and AVC delay. 2. Factory modified to include tube JAN-12H6, noise suppressor and AVC delay.
	BC-624-C	1. Tube JAN-12AH7GT added as first audio and AVC delay. 2. Squelch audio tube JAN-12AH7GT now furnishes squelch bias to the grid of the first audio tube JAN-12AH7GT instead of operating the squelch relay. 3. Third audio tube JAN-12A6 added. 4. Tube JAN-12C8 changed to AVC and second audio circuit. 5. New output transformer added.

**CHANGEOVER TO 110 VAC POWER SUPPLY
INSTRUCTIONS FOR BC-348-E-M-O-P-S SERIES
USE SCHEMATICS 1, 2 AND 3**

1. Lift the center lead from resistor 501 A-B and connect to lead coming from dynamotor terminal 3.
2. Run a lead from ground lug to pin 1 of tube A
3. Run lead from pin 7 of C to pin 7 of B.
4. Lift lead from pin 2 of C and solder to pin 7 of C.
5. Solder pin 1 and 2 of C together.
6. Place a jumper between pins 1 and 2 of tube B.
Now go to the R. F. shelf and using Schematic 3
7. Place a jumper between pin 2 and 1 of tube D.
8. Place jumper between pins 1 and 2 of tube F and snip out the old lead attached to pin 2 of tube F.
9. Run jumper between pin 7 of D and pin 7 of E.
10. Lift lead from contact 1 of switch 107, section 1, front. Solder to pin 7 of tube C.
11. Put a jumper across resistor 503 which is behind the front panel of the receiver. Take off the dial cover and change the dial lights wiring from series to parallel.

**BC-348-J-Q-N
USE SCHEMATICS 4 AND 5**

1. Snip out resistor 84 which connects pin 2 of socket D to pin 1 of the terminal board. Connect pin 1 to pin 2.
2. Run a lead from pin 7 of socket D to the terminal board pin that resistor 84 was taken from.
3. Put jumper from pin 7 socket C to pin 7 socket B.

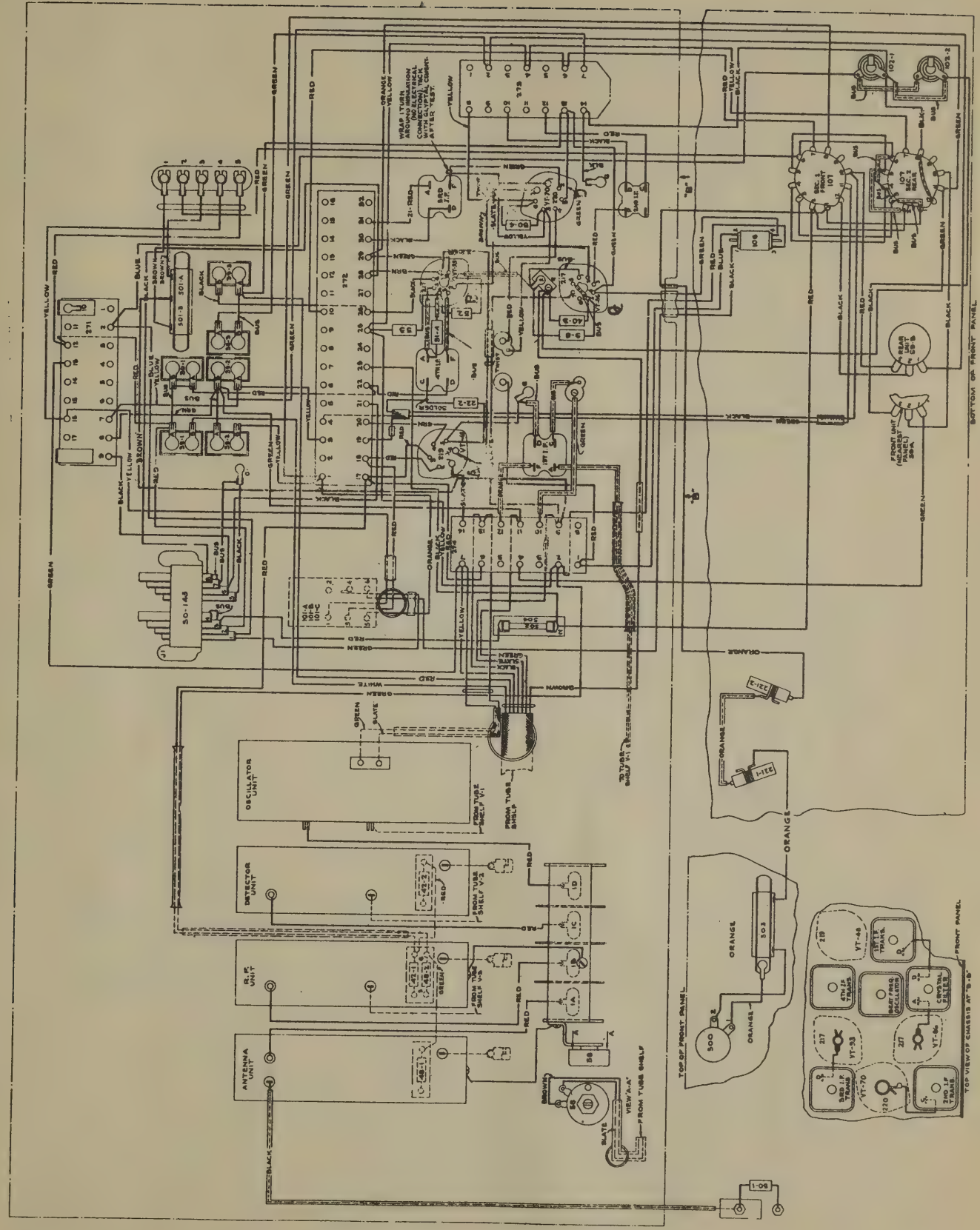
4. Solder jumper between pin 8 and pin 1 of socket B.
5. Run lead from pin 1 to pin 3 of terminal board 126.
6. Run a lead from pin 2 of socket E to pin 7 of socket F and pin 7 of socket G, first removing the leads originally on these last two.
7. Connect pin 7 to pin 8 of socket E.
8. Connect pin 2 of socket F to ground lug just below it.
9. Trace down and snip off the block lead from the dial light to the AVC-OFF-MC switch 169. Solder lead removed from switch to pin 7 of socket B.
10. Change the dial lights to parallel in place of the series wiring they now have and short out the sixty ohm resistor in series with the dimmer control.

Diagram 6 is included to show proper connections for 110 VAC operation. The power pack is built on the dynamotor mounting base after it has been completely stripped of its original parts complement. A few of the power transformers that will fit into the small space are listed on the drawing. On testing the power pack make sure the plate voltage is not over 300 volts or so. If the voltage is too high remove the input condensor. No attempt to list the numbers of chokes has been made, for the amateurs junk box usually contains a small one that will do. Use a GT tube if possible to conserve space.

Notice that the B- is put into the receiver through a filter choke. Don't make this connection to ground. Be careful that the dial lights are fed from the 6 VAC filament source. If left on the on-off switch it will short the 115 VAC.

119 ANT.

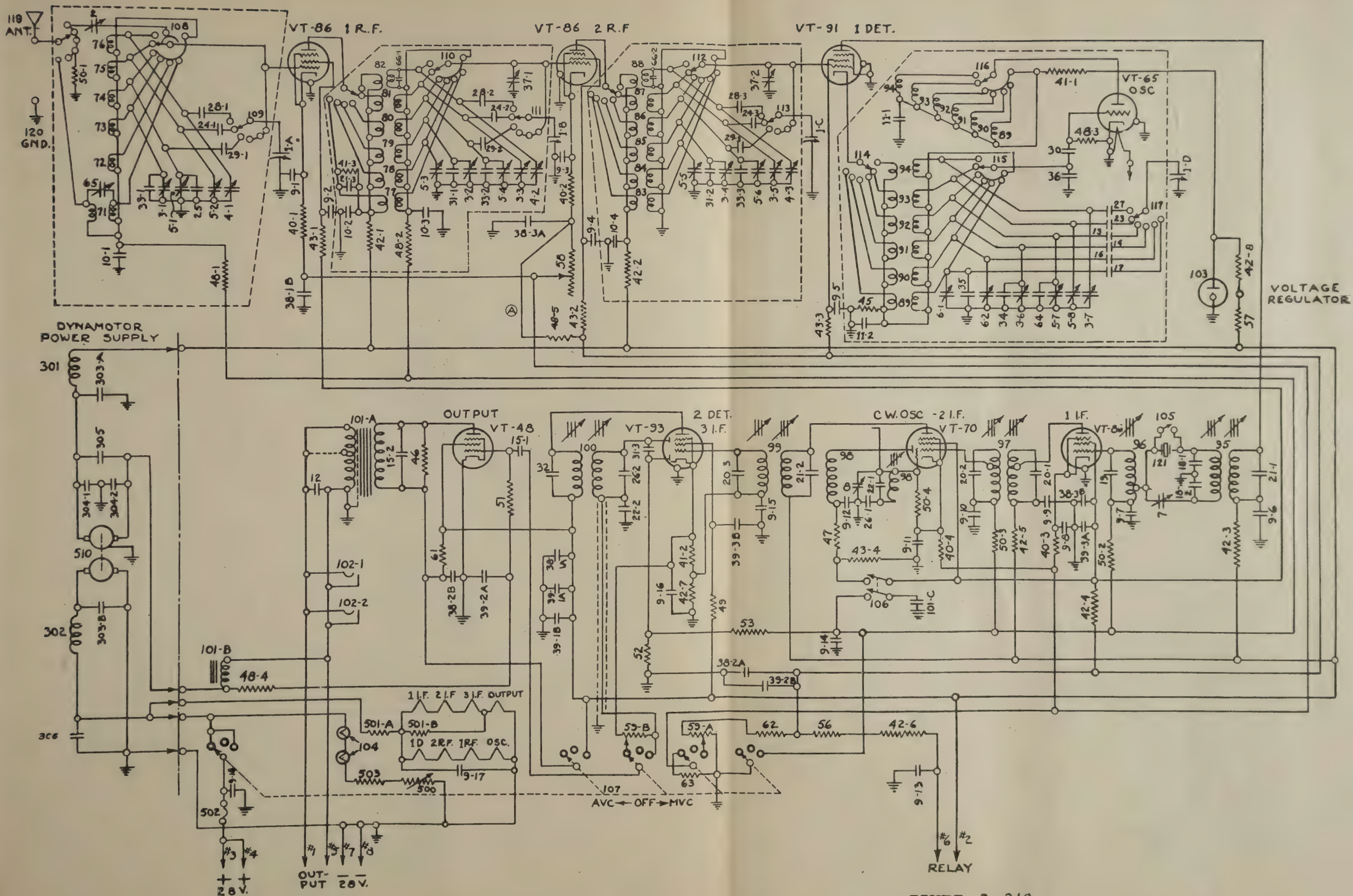
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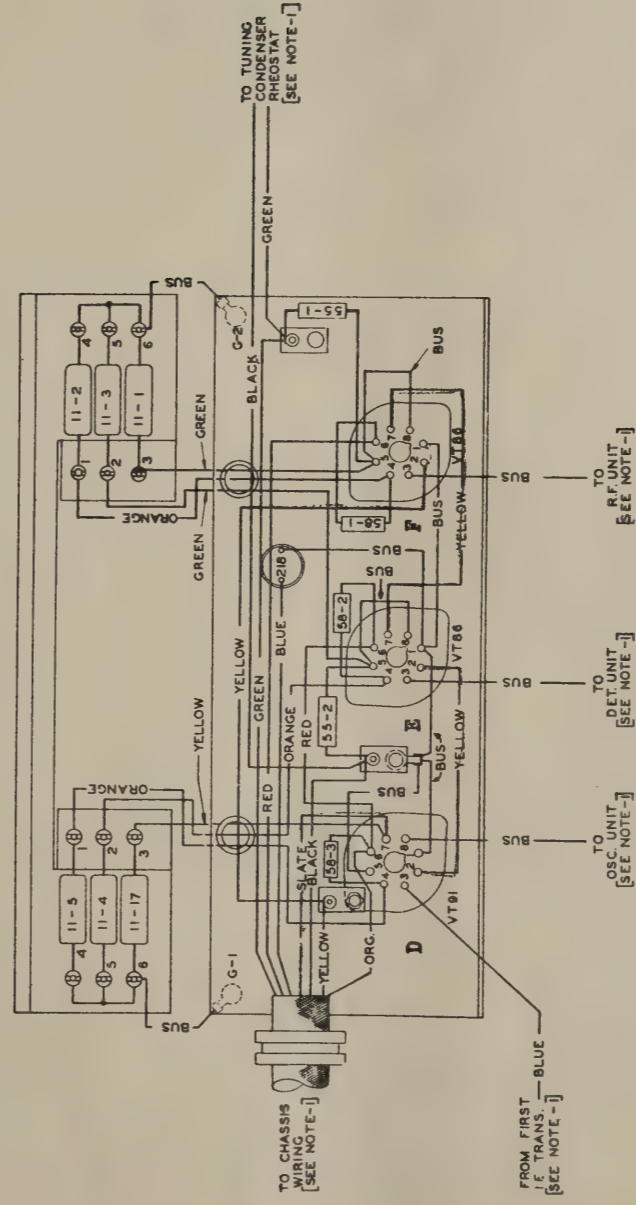
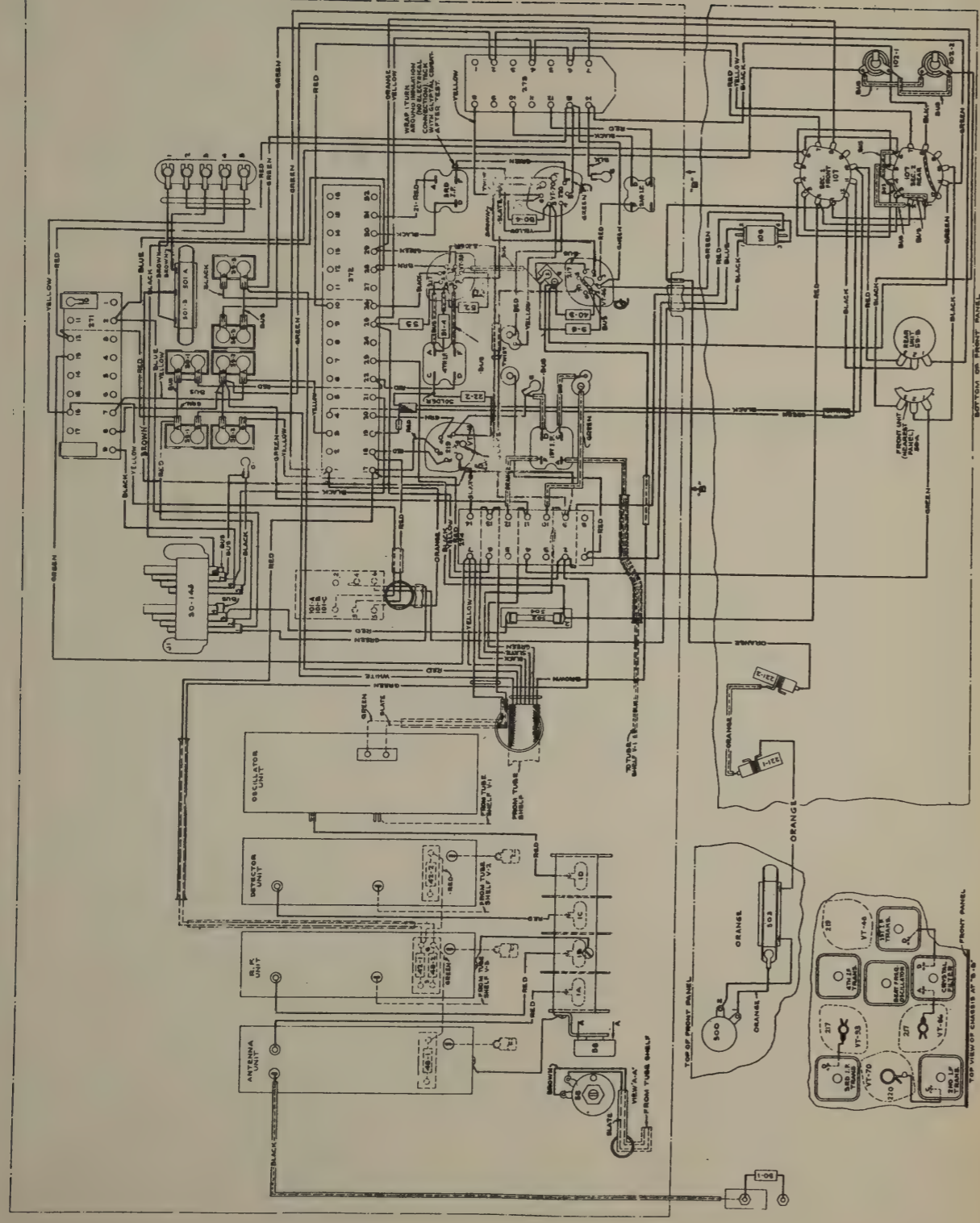


TOP OF FRONT PANEL

FRONT PANEL

TOP VIEW OF CASE AT 8-10





10 METER MOBILE TRANSMITTER AND RECEIVER

The SCR-274-N transmitter and receivers were originally made for portable use. The transmitters are light, compact, and powerful. The receivers are light, compact, and sensitive. Above all they are economical as current market prices bring them within the reach of everyone.

With these facts in mind we changed the power supplies and wiring of the units to accommodate the use of six volts as a primary source.

We gave consideration of the use of V. F. O. but decided against this for several reasons, including: the necessity of climbing out to retune, drift caused by voltage variation, etc.

The final analysis resulted in the inclusion of one of our favorite circuits to combine with the SCR-274-N Transmitter. The harmonic generating crystal oscillator of the SCR-522 transmitter BC-625. It works well with any tetrode tube and combines the better qualities of the old Tritet and still older Pierce. This gave plenty drive for the 1625s and left only the coil pruning in two inductances to finish the job.

We used the original modulator with wiring revisions to accommodate the familiar PE-103, in place of the dynamotor which comes with the equipment. The PE-103 gives us 12 volts for the filaments of the transmitter and 500 VDC for plate. Of course, any power delivering these voltages may be used.

By rewinding the antenna relay coils for twelve or six volts and installing two more ceramic feed-through insulators for the receiver antenna connection, we are practically ready to go on the air.

Of course, it's not that simple, but with the following information it won't take long to get that portable mobile working.

LET'S START, BY MODIFYING THE TRANSMITTER.

Remove the covers from the oscillator coil and the bottom of the transmitter. Remove the oscillator padding condenser. Remove the oscillator coil and pull up on it till the leads are exposed and snip them off. Take off the antenna loading coil by removing the four small screws that are in the transmitter face and hold the bracket ends. Remove the coil contactor. Take out the screws that hold the angle brackets at the foot of the final amplifier coil and the three flat fillister screws adjacent to it, which releases the final paddler condenser. Now turn the set bottom up and clean off the wiring from the oscillator tube base and all but the filament and ground leads from the target tube base. Remove the ballast resistor which parallels the target tube filament and drop the leads from the plus end down to pin No. 2 of the same tube. Remove the flexible shaft between the two tuning condensers and by removing the screws from the top, drop out the oscillator tuning condenser. Remove the antenna relay.

To start rebuilding, get a mounting terminal, or build one, with four mounting studs as shown in cut No. 10-274-N and mount the circuit components as shown. Then tuck it into the corner of the transmitter as suggested. Solder a length of stiff bus wire to the stator of the oscillator condenser on the drive shaft side and bend it so that when the condenser is replaced the bus wire will come up between the two 1625 bases and the oscillator condenser frame. Replace the condenser. Put a small mounting strip on the side as also shown in cut No. 10-274-N for the final grid choke and resistor and drill a hole for the shaft bushing in the front panel in the opposite corner from the tuning knob. This shaft is approximately 6½ inches of flexible cable plus the solid fittings.

Remove the meter and thermal unit from the antenna relay BC-442. The thermal unit is mounted on the deck

of the transmitter between the antenna coupling coil shaft and the cover. One of the holes which formerly held the loading coil contactor will give the location for drilling the other mounting hole.

The crystal supplied with the transmitter is mounted in a sealed unit with octal base contacts. The contacts used for this crystal are three and seven. The same socket was utilized for the 7 mc crystal since it was mounted in an FT-243 holder. If only old type crystals are available an adapter may be made from an octal tube base.

Now let's get to the coils. The oscillator coil you will notice, has an inner coil suspended on cross wires. If you possess cutters that will reach in the coil, cut out the soldered chunk in the center and gently (that ceramic cracks if you rough it) pull the cross wires out. Not having the cutters for the job, put the coil in a clamp or vise and heat the cross until it is good and hot, clear to the outside, and pull the pins out using a pair of pliers and much speed and dexterity. Clean off all the old winding, being careful to keep the heavy primary winding in good shape. Bend the grounding lug at the base out of the way and cut it off.

When ready, take the old primary and wind it back on for 5 turns, spacing the wire one-half wire diameter or, if using transmitter BC-457, use the groove as in the original. Start at the bottom and wind counter-clockwise; tuck your top turn into the hole about midway up the coil. The hole faces the oscillator tube when the coil is in position. Bring the free end down inside the coil and attach it to coil pin No. 8 (pin numbers are shown in transmitter figure 5-274-N diagram). Solder a lead from the start of the winding to coil pin No. 1.

After stripping the final tank T-54 of all but the coupling loop (that includes the parasitic suppressors) get into the bottom and reduce the winding on the coupling loop by at least one turn.

Now, working with a soldering iron and needlenose pliers, remove the lug that was used to anchor the parasitic suppressors. When free, use the same finger burning process to reinsert in the hole at the back of the coil nearest the tubes. This allows the coil ending to be as close as possible to the 1625's plate caps and offers an anchor spot for the plate leads. Starting from the bottom solder lug of the coil, wind counter-clockwise up the form, at such an angle as to cause the first quarter turn of the wire to pass through the angle slot on the coil body, and then wind three turns of No. 12 bare tinned copper wire, spacing the turns about ¼ inch and ending on the top lug.

Neither coil has any use for the slug unless someone would like to make the two circuits track. This would be handy in a small way, but for the sake of simplicity, we decided against this.

The circuit capacities in the final amplifier pile up due to construction details, and this, at first, caused the tuning to be most critical and in the minimum extreme of the condenser. Rather than remove the condenser plates, we tapped down the lead, from condenser C65 to plate, three-fourths of a turn and gave ourselves a little room on the tuning dial. Tuning is not critical as far as divisions go, due to the large geared-down ratio of knob to shaft, and because of the tapped down connection. The parasitic suppressors originally on the coil will not do, for they absorb 28 mc with enough gusto to burn themselves up. With misgivings, we cut them out and found no trace of parasitics, and so, did not replace them. It may well be that others will not have that much blind luck, but any of the usual type in general use for those frequencies should do.

The antenna relay poses a question for the user. In the test setup the relay supplied was removed, taken apart, the windings removed and rewound with No. 26 SCC wire. Reassembled, it worked with fair snap at six volts. To be sure of positive action, it was later replaced with a standard

Leach relay. A coaxial connector (Jones 101), was fitted into the transmitter front in place of the original feed through, and another further down, to the side, for a lead to the receiver. In either case, twelve or six volts may be used to activate the relay, depending on which type is at hand, for the relay is activated from a contactor in relay 3-E-6 in the PE-103.

If the original antenna relay is kept, the left hand bracket of the loading coil must be retained, for the contactor it holds is part of the antenna relay. The bottom contact may be changed to a feed-through bushing and used for the receiver antenna post. The transmitter relay, K-53, under the chassis is not essential and rather in the way. This was removed entirely and leads from it, soldered direct.

Due to the new location of the final grid resistor, the old connection to pin two of J-64 was not used. This connected to the grid resistor and allowed voltage impressed across it to be read when a certain type of test gear was used. As there are no metering jacks in the rig, this may be connected by a lead to the grid connection in mention and used to tune up with, using a voltmeter. This is difficult, however, and in our model, two closed circuit jacks were mounted in insulated bushings in the side of the transmitter above and forward of that portion covered by the mounting rack. One of these was used in the final grid circuit to read grid current, and the other in the plate circuit. These jacks may be installed, if desired, in the mounting rack, and would then read plate current of the oscillator and final. We preferred to read the final grid current for check purposes and so installed the jacks in the set.

Now some word about the antenna current indicator. In our model, the thermocouple from the separate antenna relay was mounted in the transmitter proper and the ground lead from the coupling coil was piped through the R. F. end of the thermocouple to ground. By grounding the negative side of the thermocouple output and running a lead from the positive, back through and under the chassis deck to pin No. 2 of J-64 which, as we above stated, is not used, we then had a connection back through the system to the control head utilizing one of the selector wires which is not in use. This enabled us to mount the indicator from relay BC-442 on a small plate affixed to the transmitter remote control and serves at all times to tell whether no answer from a call is due to skip, QRM, or no output from the transmitter.

A 12A6 tube was used for the oscillator as it was at hand in one of the 274N receivers. It works nicely with plenty of output.

For those inclined to fine detail work the modulating equipment may be stripped out of case and mounted either in the transmitter or on the transmitter rack. As there is an unused tube socket in the transmitter, this would accommodate a tube for the modulator. 6L6s would do the job nicely. Put the filaments in series. One for the crystal oscillator and one for modulation.

MODULATOR

The modulator will have to undergo some alteration; not in changing circuits but in eliminating them. Number one item is the tone oscillator and its associated components. This tube may be used if any other type mike is wanted, but if the old faithful carbon mike is retained, there is no use for it. The relays are 24 volt and difficult to rewire, so were eliminated by using those in the PE-103.

Taking out this one tube looks simple and is, but the difficulty lies in finding the right wire to snip out. A practical wiring diagram is supplied, along with the schematic, and to save reams of paper and you, hours of time, we suggest you turn the modulator to a good light, and by studying the schematic, and locating the part in question by the practical drawing, put in the changes given in drawing No. 11-274-N. Briefly touched on, the changes are as follows:

The off-on switch originally supplied filament current to all heaters. The plus lead to the heaters has been lifted from J-54, pin 15, and a ground put to pin 15 instead. Pin 18 of that plug now goes to pin No. 1, J-52, and serves to complete the circuit through the genemotor energizing relay of PE-103—PL-148 and J-53 is now unused.

The grid lead which carries the audio from the junction of R-56 and R-55, which bridge the secondary of the mike transformer, is moved up to its new position of the top of R-56. This increases the drive of the audio tube just enough to overcome the loss of higher voltage in the microphone.

C-54-B which has a value of 20 mfd is cut out of the circuit because of the 12 volts feeding the filament is now negative. This is cured by placing a standard electrolytic, cathode by-pass, condenser in its place observing proper polarity.

R-65 is a portion of the voltage divider in the modulator that supplies the oscillator voltage. It should be replaced with a 10 K. 10 watt resistor.

POWER SUPPLY PE-103

In considering the various ways to use the PE-103 Power Supply two questions arose. The first, would the wiring be left as it was originally? Two, what input was most likely to be used? Both questions can be answered at once. Few amateurs will have a twelve volt battery and the original wiring will seldom, if ever, be just what is needed. Therefore, we changed the wiring as shown on plate No. 12-274-N.

No particularly drastic revisions were attempted. When pin No. 1 of the output plug (a PL-51 and socket from the receiver—as no one seems to have the plug that goes with the PE-103) is grounded through the off-on switch of the remote control, the main contactor 3-E-2 from six volts source is closed, starting the dynamotor. Six volts was wired into the double pole single throw relay No. 3-E-6 and when the output lead from this coil is grounded through the mike push-to-talk button, 500 volts for the plates is cut into the modulator and six volts for the trans-receiver relay goes to the transmitter. The circuit breaker No. 3-E-4 and 3-E-3 are in the start-stop line and release the main contactor on any overload either in input or output.

Care must be exercised to determine what type of dynamotor is in your PE-103. There seems to be two types which differ mainly in which side of the low voltage input is connected to plus twelve volts of the generator. Without attention to this it is quite easy to get 18 volts DC across your filaments.

RECEIVER

To make the receiver function on ten meters is relatively simple. The only necessary changes can be done in two steps. The first, is the coil rewinding. Remove the bottom plate and all covers. To get the inner cover which is over the tuning condensers, off, it is necessary to pull the tubes and IF transformers. Two screws each hold the IF transformers on their sockets.

Now remove the RF coils, which are in the bottom front of the receiver. Two small screws hold the coils in. They may be found on the outside of each end of the RF coil assembly. The strip pulls out and coils may be separately removed when the four screws holding them in the can are removed. Each coil has a powdered iron slug mounted on a screw and held in place by fiber tab sprung across the inside of the form. For our purpose of quick change to 10 meter we simply removed the slug and forgot them. Not that they would not be useful but our business concerned only the pulling of turns from the original windings. This leaves the coils unbalanced for proper slug setting so it was simpler to do without.

In pulling coil turns, pull from the bottom (towards the socket) in the RF coils and the top in the oscillator coil.

In the antenna coil, notice that the method of input coupling has changed. The small series condenser in the antenna lead has been removed and lead run straight from the antenna post to the low impedance tap on the coil. The small condenser (C-1) is hidden behind the tuning condenser bank. There is an unused tap on the antenna coil which is used for the new antenna lead. By following drawing 8-274-N the coil dope should be easy to duplicate.

No particularly fine attempt was made to make tracking 100% across the dial. When the tracking was sufficient to fully cover the 10 meter band (from 8.3 to 9, on the dial), we started the second stage of conversion. The stator leads and the lead to the oscillator series padder condenser were disconnected. The dial was removed from the front of the receiver and the four screws holding the main condenser were removed. Then by rocking the condenser back it may be removed from the chassis. With the sidecutters snip off the long narrow tail from each rotor plate. This gives us room to mount a series condenser marked CX in drawing No. 8-274-N on the inside bottom of each of the three sections of the main tuning condenser. These series jobs are made by the Erie Resistor Co. and are designated as ceramicon trimmer, type TS2A and have a value of 7 to 45 mmf. The trimmer stator lug projects straight along the main condenser stator plates and was soldered tight to them. Be careful in placing them to prevent the ceramicons from shorting on the RF coil plug base leads. Now put the tuning condenser back in place and hook up as it was before, using the ceramicons as the new stator leads.

With the coils complete and in place, turn the antenna and RF ceramicons to full capacity and the oscillator section about 30 degrees out. All of the original trimmers are left just slightly engaged. Now by means of a signal generator or by tuning and trimming till a strong signal is found, the set may be lined up. As individuals will vary in methods and ways to convert this receiver; our treatment, outlined above, is but a rough sketch of what may be accomplished. Our guiding thought in making these changes was to find the easiest and least expensive method to convert to 10 meters. No particular time was spent in evolving fine detail or procedure. The net result of these experiments was a transmitter with plenty of output and ease of operation and a receiver with fair sensitivity with the 10 meter band spread out over three major divisions of receiver remote tuning dial.

We suggest that user build into the receiver one of the simpler type noise limiting circuits, preferably one using IN34 crystals for diodes, for ignition noise can be quite a problem with this receiver.

RECEIVER FILAMENT CONVERSION

For 12 (6) volt operation it will be necessary to re-wire the tube filaments in parallel. In making these changes consult the practical wiring diagram for the receiver.

First remove the screws, by means of which, the by-pass condensers are mounted on each side of the chassis and pull up these condensers so that the tube sockets are exposed. Filament connections are made to pins 2 and 7 except tube VT-133(V7), which are made to pins 7 and 8.

Beginning with V8, remove the lead from pin 7 and re-connect it to pin 2. Ground pin 7. Remove the lead from pin 2 of V5 and connect it to pin 7. Ground pin 2. Remove lead from pin 2 of V4 and connect it to pin 7. Ground pin 2 which completes this modification.

The rack which the SCR-274-N transmitter slides into has places for two transmitters. As only one is needed, we suggest, and have used, that space for receiver.

The receiver rack has places for three receivers. We saved free one rack complete with plugs, clamps and inter-connection housing and bolted this unit in the unused transmitter place. While sawing we also cut one end or one

complete section from the triple receiver remote control, which mounted with the transmitter remote control makes a neat small control installation.

For receiver power, several schemes were devised to obtain B+ voltage from the PE-103 but all were discarded because of the high current drawn by this unit. For listening over the band there is no sense wasting that much juice. We ended up by paralleling the receiver filament circuits and replaced the tubes in the receiver with equivalent six volt tubes. B+ is obtained from a Mallory six volt vibropack type VP-522. By using spacing washers between the vibropack and the old dynamotor mounting base we have a demountable vibropack held on the rubber shock mounts by snap-slides.

OPERATING NOTES FOR THE 10 METER MOBILE TRANSMITTER

In operation the crystal oscillator draws approximately 21 mills plate and screen. At this current 7 mills drive may be realized in the grids of the amplifier. This will seem high but for the use of tubes in parallel that double in the plate, it may be necessary.

Final plate current at no load is also high; somewhere between 45 and 60 mills, but this condition is not unusual in tetrodes, doubling at 28 mc. The amplifier may be loaded up to 120 mills by the usual quarter wave, whip antenna.

Some difficulty may be experienced with downward modulation unless all load factors are carefully controlled. Please remember that screen grid modulation is easy to abuse. Unlike some modulation methods the screen grid voltage must be carefully handled. The amount of drive, the amount of load and the amount of modulation voltage is critical. A modulation percentage of about 80 may be expected from this transmitter without trouble. Do not remove resistor R-62 from the modulator transformer secondary in an effort to get more signal. Without it the screen voltage runs wild on peaks. One of the principal reasons for using the antenna current indicator is to check for downward modulation which is almost sure indication of improper screen operation. Bias voltages must be high, above one hundred volts, before the modulation settles down to good work.

Twenty meters can be reached in the same manner as the ten meter conversion with the exception of the coils and crystal used.

The oscillator coil will have seven turns and the amplifier coil will have five. For twenty meters the parasitic suppressors may be left in and there is no need to shorten the plate leads by putting the solder lug in the back of the coil. An 80 meter crystal is used in this version.

For those who possess the BC-459, 20 meter operation is simple to the extreme. This unit tunes from 7 to 9.1 mc. The oscillator gives enough drive to allow doubling in the amplifier plate circuit by rewinding the coil in that stage to hit 14 mc and separating the tuning condensers (don't forget the main dial drive is connected to the amplifier condenser first) tuning shafts. Full power cannot be realized but twenty watts peak can be extracted and that's plenty for exciting a following stage.

For those who have not been able to obtain the BC-459 we have included in these pages an outline of the steps necessary to convert the BC-458 to cover the 7 to 7.4 mc range as it normally covers 5.3 to 7. (We also include the data for changing the BC-457, 4 to 5.3 mc to cover the 80 meter range.) The revamping did not change the frequency stability enough to notice.

For those who will want 40 meter CW operation there are several ways of keying the transmitter. In aircraft installation the transmitters are keyed by using antenna relay unit BC-442 and letting the transmitter run continuously. This is not good practice for amateur use and we suggest

revising the bias system of the amplifier for bias keying. We have seen and heard some stations that use relay K-53 for keying but in most cases there was a noticeable chirp on the signal. Please note that bias resistor R-75 is not a keying aid. It serves only to self bias the amplifier to nearly cut-off when relay K-53 is open.

INSTRUCTIONS FOR CONVERTING THE BC-458-A (5.3-7 mcs.) TO 40 METER USE

If the transmitter is to be used with a 24 volt supply no changes are necessary. If a 12 volt supply is to be used the tube filaments must be wired in parallel. The relays should be closed or removed entirely. If the unit is to be used as a V.F.O., the antenna loading coil may be removed and the variable link on the final tank coil terminated in a suitable low impedance jack mounted on the side or face of the unit.

There are two methods for changing the frequency range of the transmitter. The simplest is as follows:

Set the dial at 7.0 and remove the shield can from the oscillator section. Loosen the locking set screw and reduce the capacity of the oscillator padding condenser. With the aid of a calibrated receiver or frequency meter, adjust the capacity of the padder to the highest frequency (7.3 or 7.4 mcs.). Place a milliammeter in the high voltage lead of the final amplifier and adjust the amplifier padder for minimum plate current.

This method is satisfactory if one is not interested in the dial being calibrated and wishes to set his frequency on the frequency of the station to be called. This is accomplished by tuning the V.F.O. to the frequency to which the receiver is tuned. If dial calibration is desired, the following method should be used:

Remove the oscillator shield can and short out exactly one turn at the top of the oscillator coil; screw the iron cord to within one turn of being all the way in, and replace the shield can. Be sure to replace the can in the final position as any change in the tightness of the shield will change the frequency. Adjust the trimmer for the highest frequency (7.4) with the dial set at 7.0. After this frequency has been set at exactly 7.0 on the dial set the dial to 5.8 mcs. which is 6200 kcs. (the frequency of the crystal) and trim with the iron core slug until resonance is indicated by the magic eye. Retune to 7.0 on the dial and retune the oscillator padder. It may be necessary to repeat the procedure several times to insure proper tracking. After the oscillator is tracking properly the same procedure is followed with the amplifier. Short one turn on the amplifier tank coil and screw the slug down to within two turns of being all the way in. Tune the amplifier trimmer and the iron cord slug for minimum plate current which should be within four milliamperes of the same value at both ends of the dial.

It may be desirable to cover the numbers on the dial with a decal but the unit can be operated very easily by marking the dial settings with the corresponding frequencies on the small plate on the front of the unit as shown in the example below:

Dial	Frequency
5.8	6.2 mcs.
6.6	7.0
6.7	7.1
6.8	7.2
6.9	7.3
7.0	7.4

INSTRUCTIONS FOR CONVERTING THE BC-457-A (4-5.3 mcs.) TO 80 METER USE

If the transmitter is to be used with a 24 volt supply no changes are necessary. If a 12 volt supply is to be used the tube filaments must be wired in parallel. The relays should be wired closed or removed entirely. If the unit is

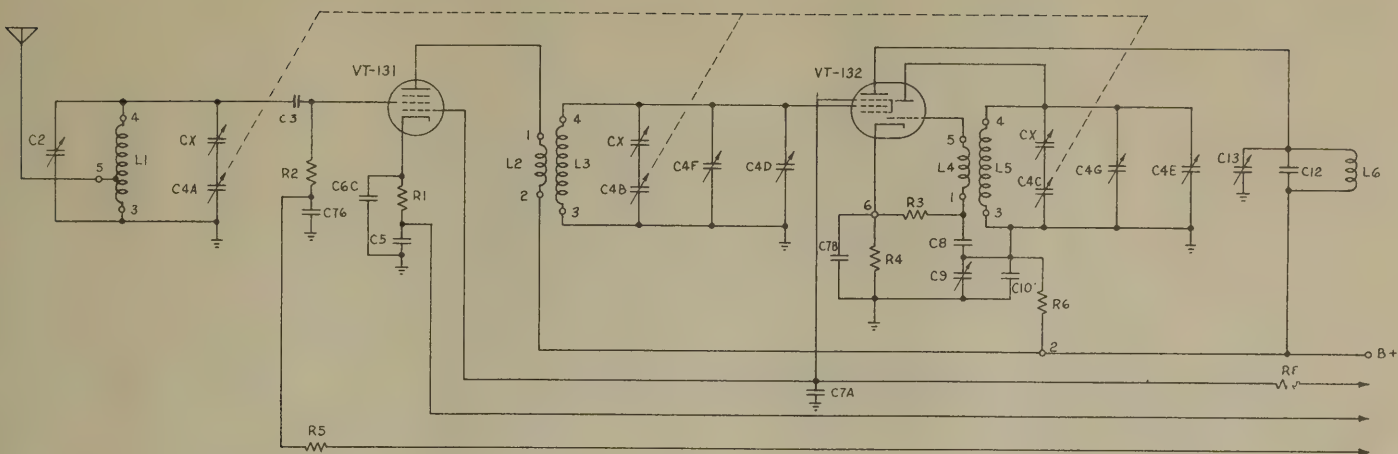
to be used as a V.F.O. the antenna loading coil may be removed and the variable link on the final tank coil terminated in a suitable low impedance jack mounted on the side or face to the unit.

First remove the shield can over the oscillator section and add four turns to the top of the oscillator coil. This may be done easily by using a small C clamp fastened to the top turn so the coil will not unwind and soldering a length of bell wire or hook-up wire to the end of the winding. After winding four turns, re-solder the end to the condenser lead and remove the C clamp. Insulated wire is suggested since it is necessary to close space the turns. Set the dial to approximately 5.1 which corresponds to 4.6 mcs. (the crystal frequency) and adjust the tuning slug until the magic eye indicates resonance. Set the dial at 4.0 which should be 3.5 mcs. This can be checked by means of a calibrated receiver or frequency meter. If the 3.5-4.6 range falls outside the dial readings 4.-5.1 decrease the capacity of the padder. If this range falls inside these settings, increase the capacity. It will be necessary to make these adjustments several times to make the unit track properly.

After the oscillator is tracking correctly the amplifier must be adjusted. Add four turns to the top of the amplifier tank coil and insert a milliammeter in the plate circuit. Adjust the amplifier padder for minimum plate current which should be within three milliamperes for the two ends of the band. If the difference is greater the capacity should be adjusted to give an almost constant value between 3.5 and 4 mcs. as the 4.6 mcs. frequency will be used only to check the calibration and higher current at that frequency is of no consequence. If desired, the unit can be made to track over the entire band.

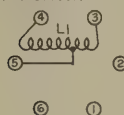
It may be desired to cover the dial settings with a decal but the unit can be operated very easily by marking the dial settings with the corresponding frequencies on the small plate on the front of the unit as shown in the example below:

Dial	Frequency
4.0	3.5
4.1	3.6
4.2	3.7
4.3	3.8
4.4	3.9
4.5	4.0



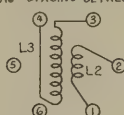
ANTENNA COIL

L1 - 5 1/2 TURNS
ANTENNA TAP 1 1/2 TURNS
FROM BOTTOM



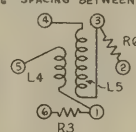
R.F. COIL

L2 - 4 1/2 TURNS CLOSE WOUND
L3 - 6 TURNS
1/16" SPACING BETWEEN COILS



OSCILLATOR COIL

L4 - 3 1/2 TURNS CLOSE WOUND
L5 - 5 TURNS
1/16" SPACING BETWEEN COILS



NOTE

THE R F SECTION REMAINS UNCHANGED WITH THE EXCEPTION OF THE ANTENNA COIL AND THE ADDITION OF SERIES CONDENSOR C X WHICH IS A VARIABLE CERAMIC TRIMMER CONDENSOR, 7 TO 45 MMFD

FIGURE 8-274N

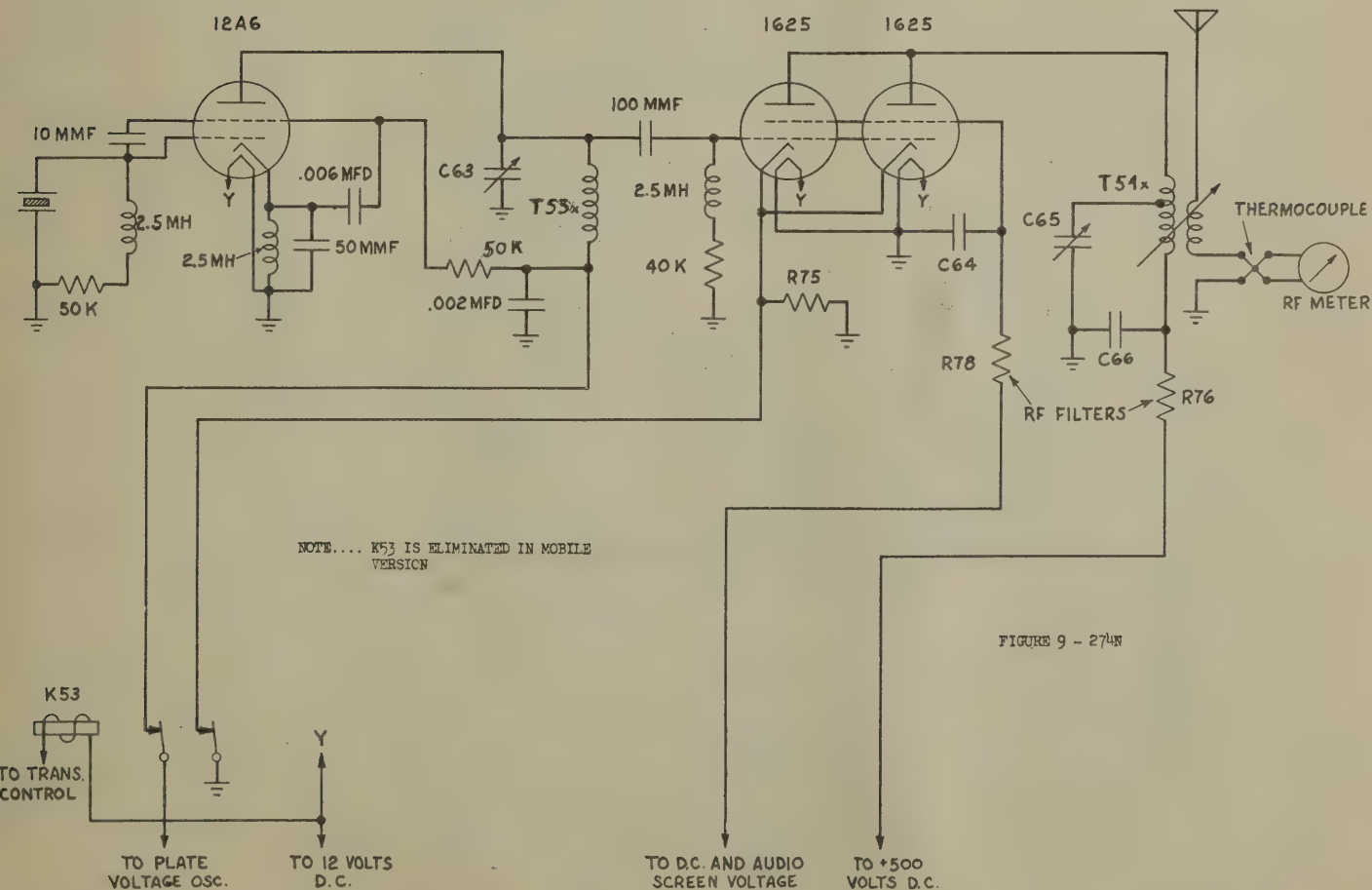


FIGURE 9 - 274N

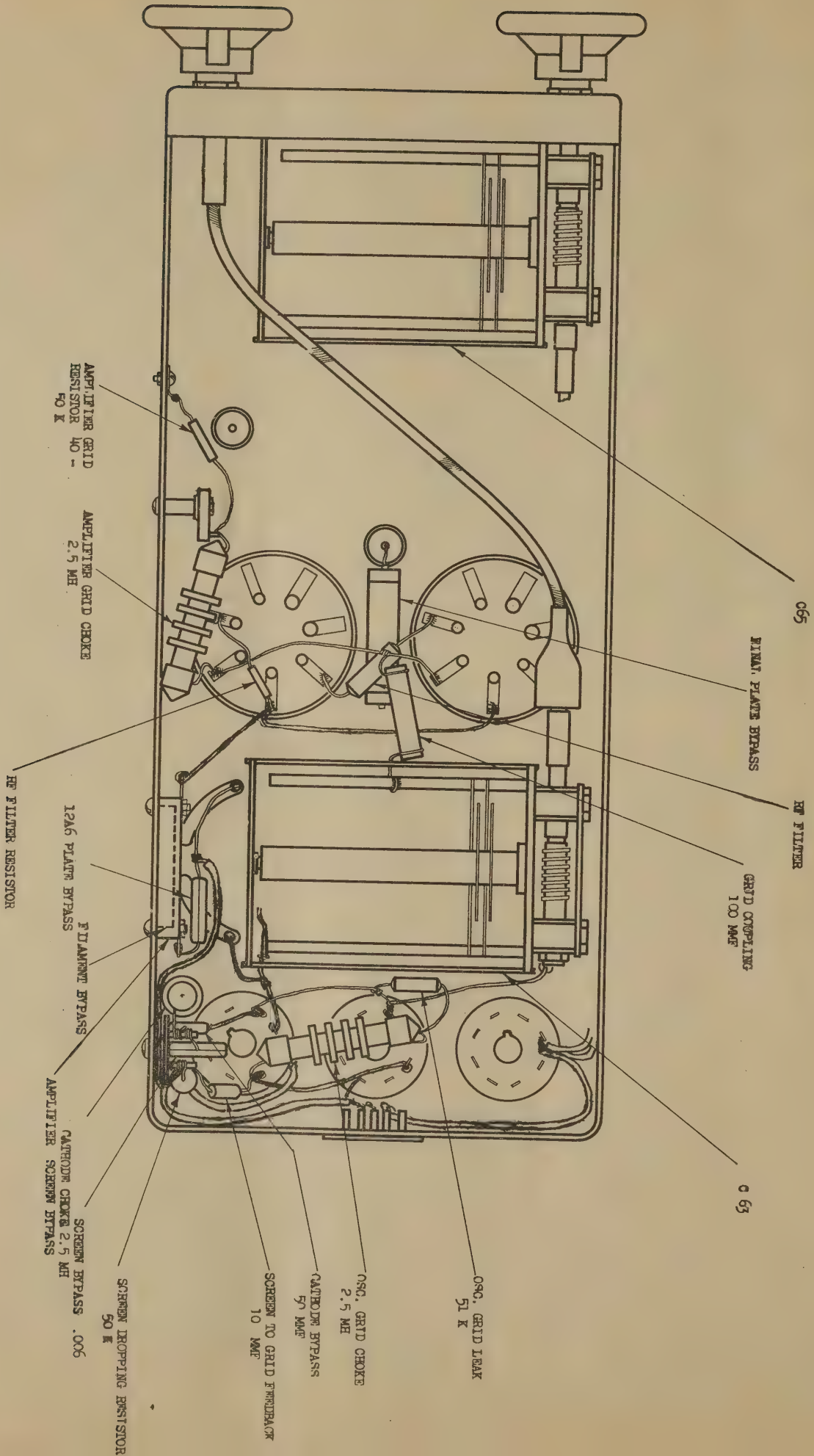


FIGURE 10-274N

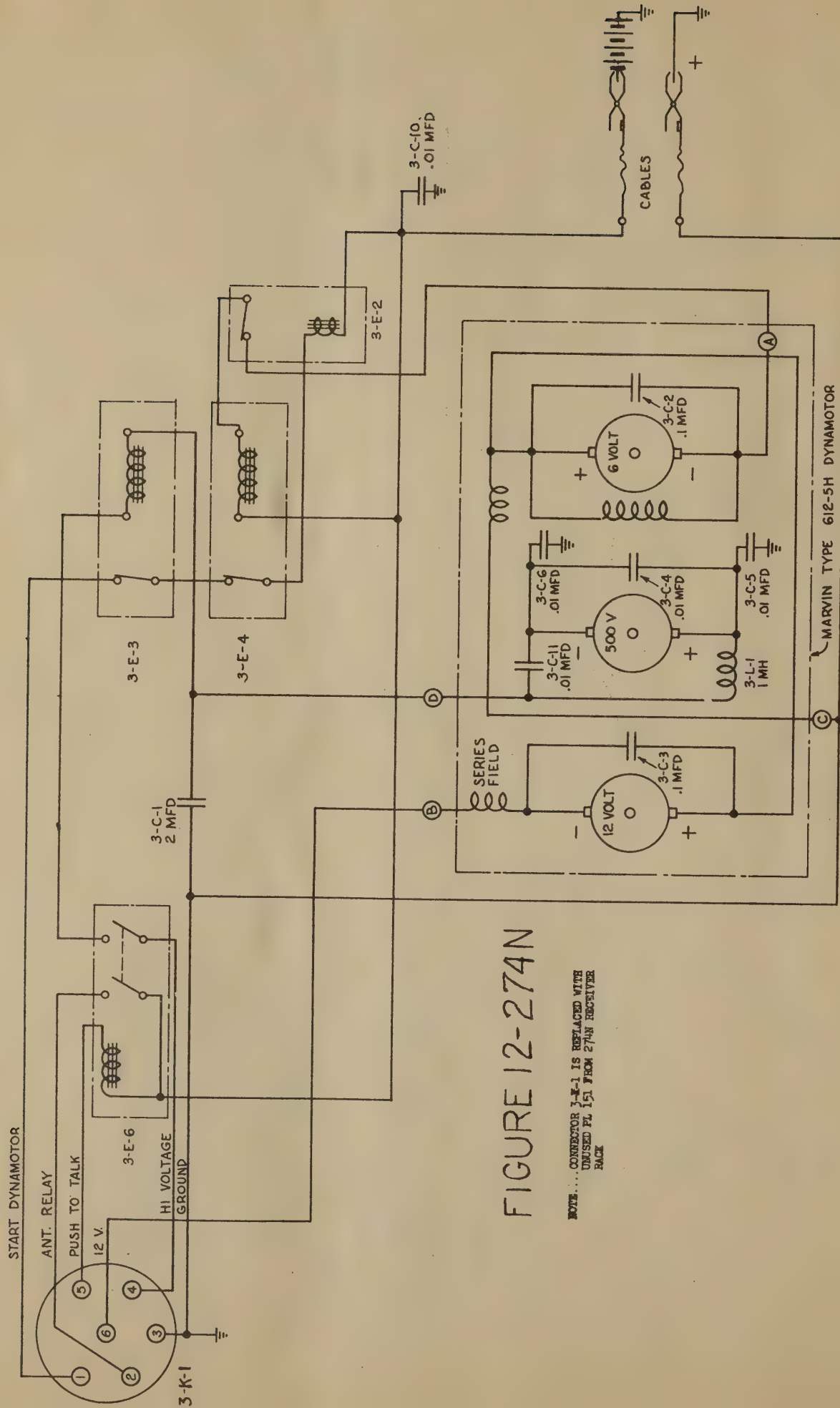
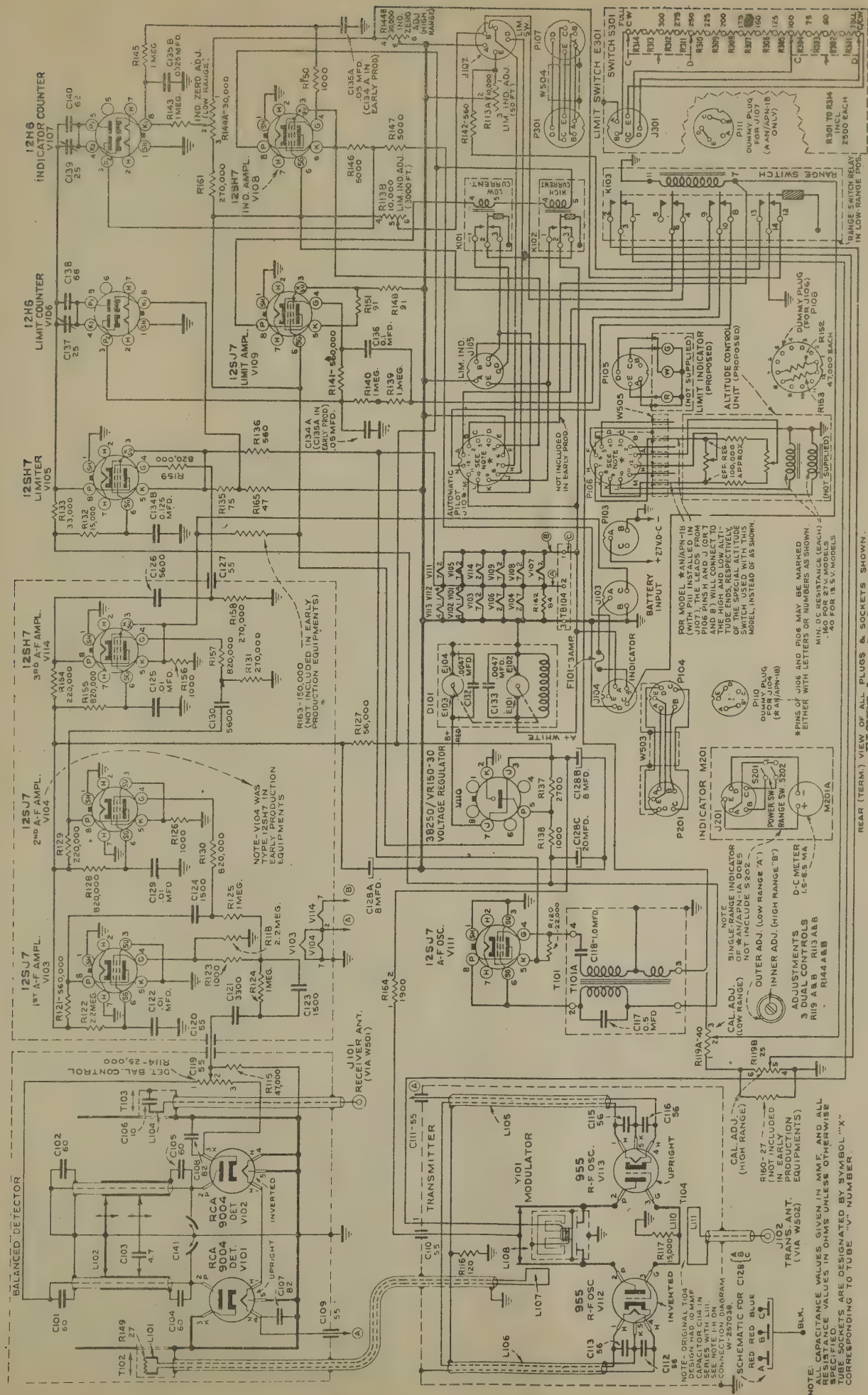


FIGURE 12-274N

NOTE... CONNECTOR 3-E-1 IS REPLACED WITH
UNUSED PIN 151 FROM 274N RECEIVER
RACK



REAR (TERM.) VIEW OF ALL PLUGS & SOCKETS SHOWN.

FIGURE 1 - APN-1

NOTE: ALL CAPACITANCE VALUES GIVEN IN MMF. AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED. TUBE SOCKETS ARE DESIGNATED BY SYMBOL "X" CORRESPONDING TO TUBE NUMBER.

SCHEMATIC FOR C128 (18)
RED RED BLUE
A B C

TRANS. ANT. (VIA W502)
J102

955 R-F OSC. V112
C113 56

955 R-F OSC. V113 56

MODULATOR
Y101

TRANSMITTER
C111 55

RECEIVER ANT. (VIA W501)
J101

12SJ7 A-F OSC. V111 8

38250/VR150-30 VOLTAGE REGULATOR
V110

12SJ7 1ST A-F AMPL. V103 8

12SJ7 2ND A-F AMPL. V104 8

12SH7 3RD A-F AMPL. V114 8

12SH7 LIMITER V105 8

12SH7 LIMIT COUNTER V106 8

12SH7 INDICATOR COUNTER V107 8

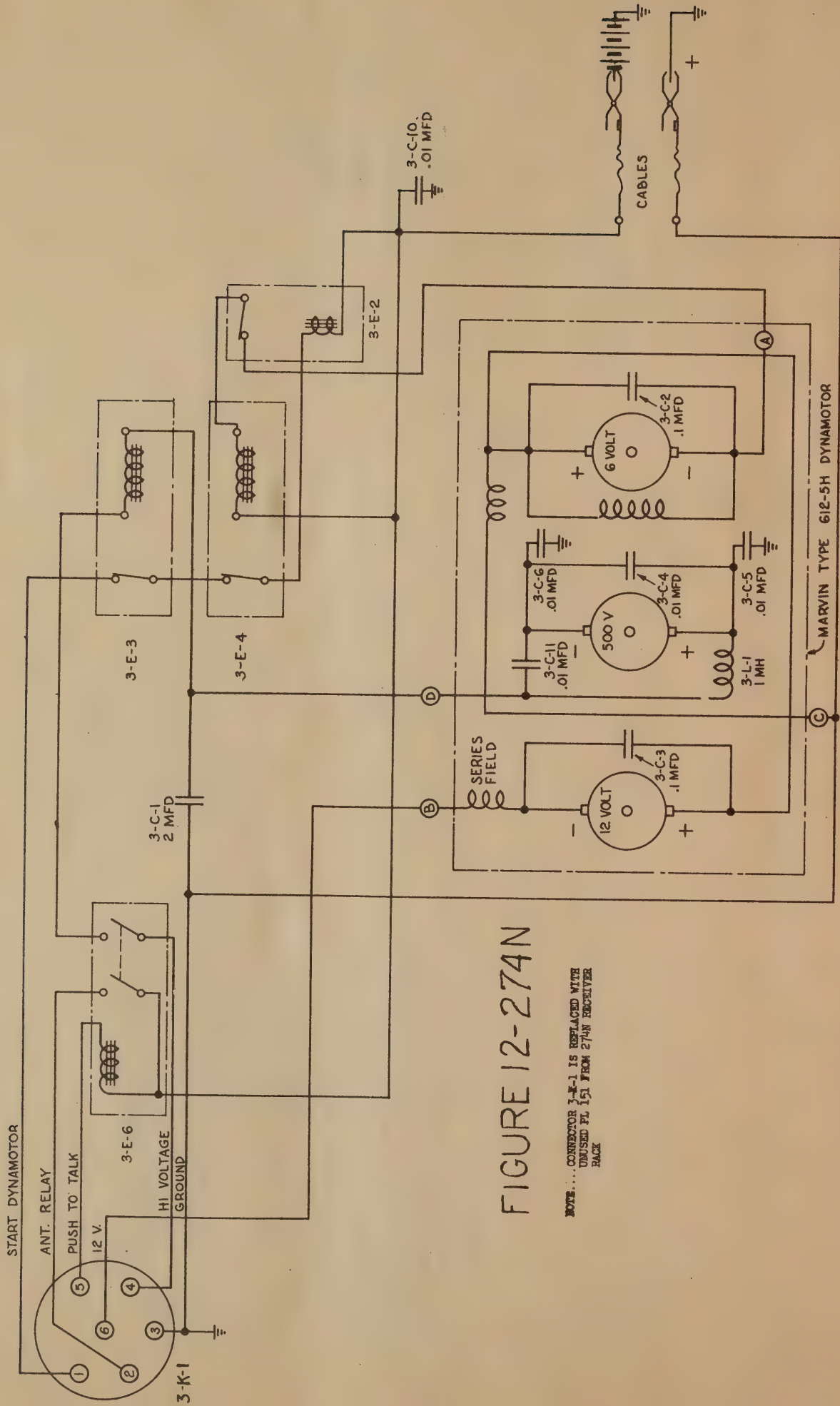
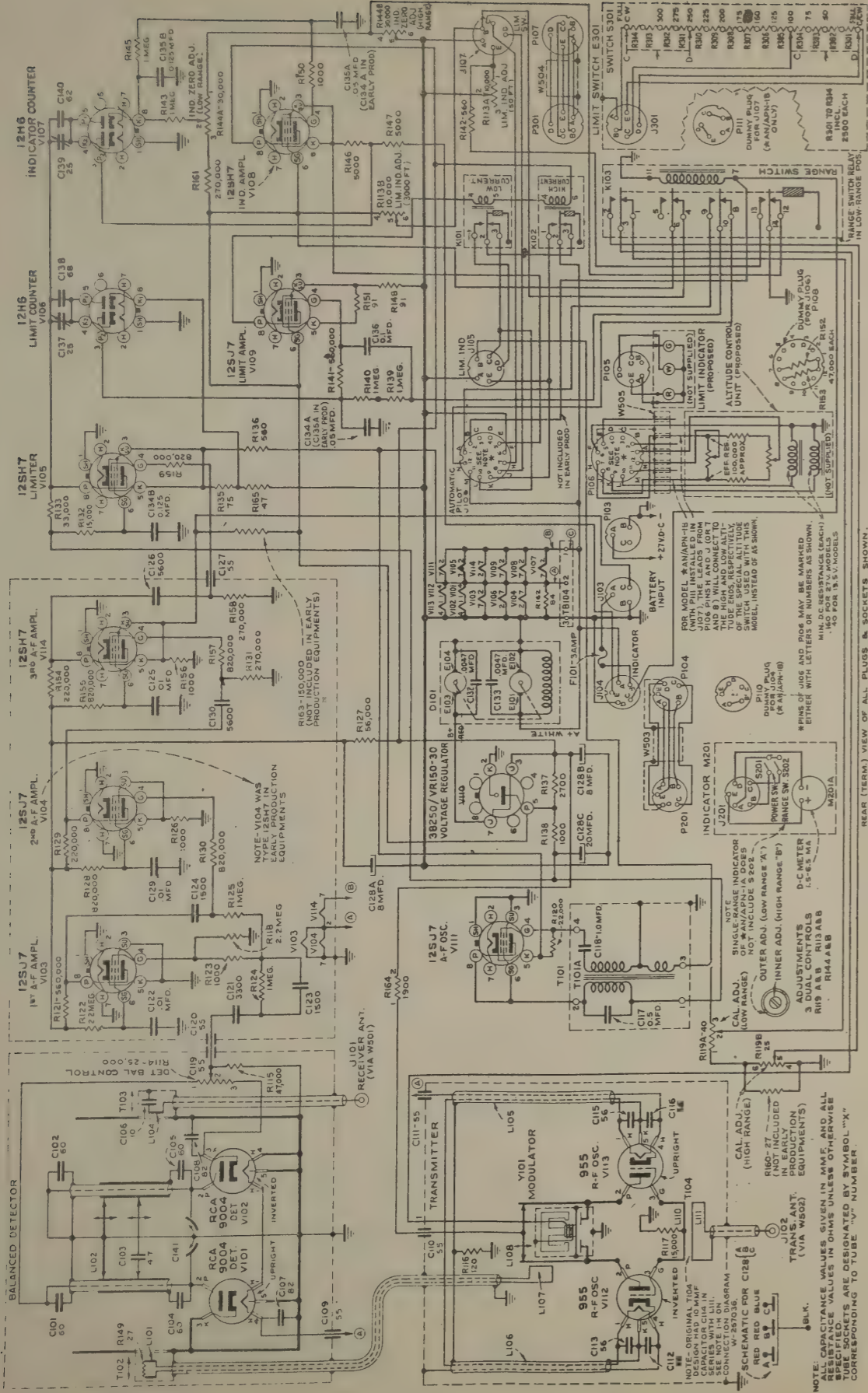
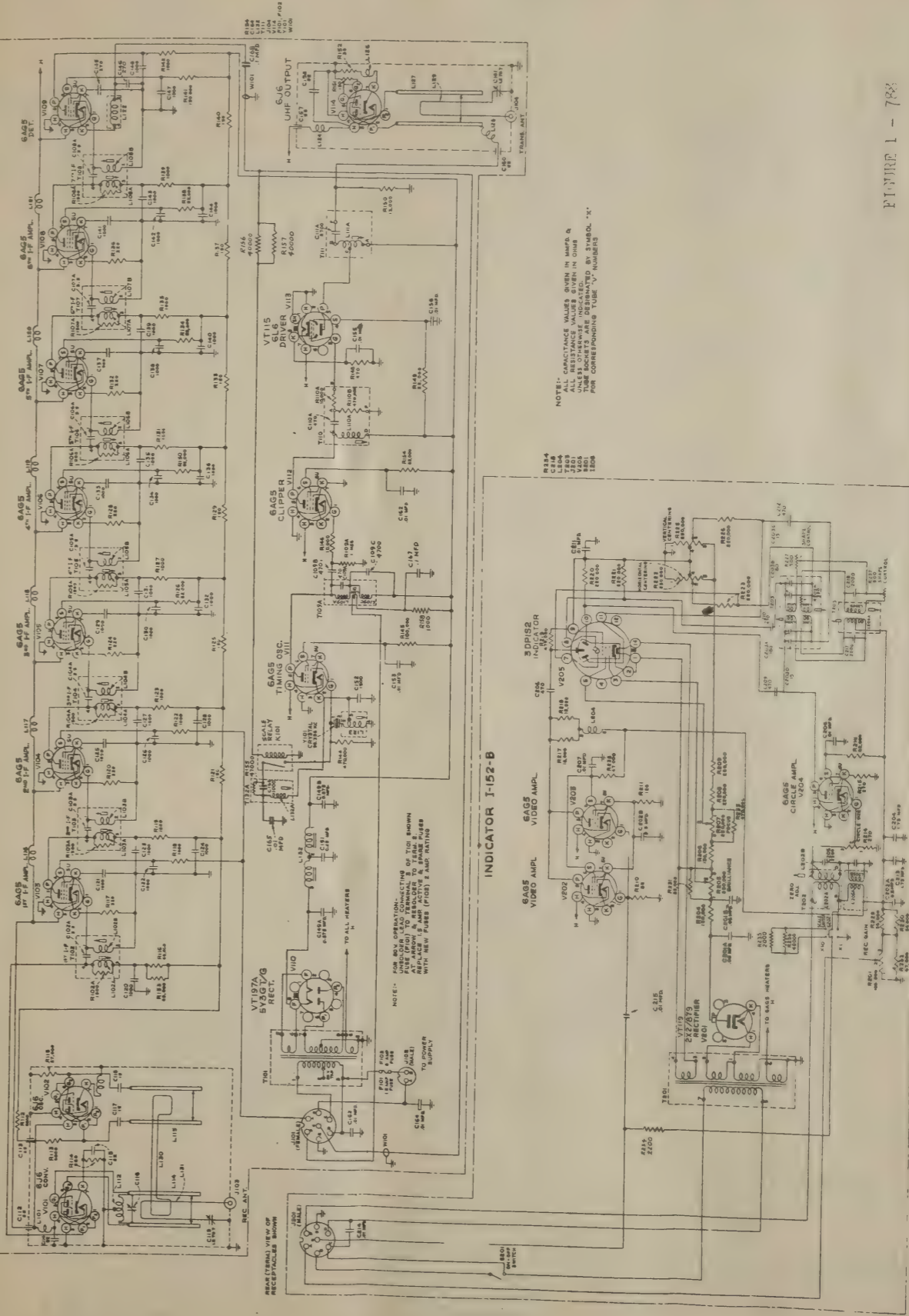


FIGURE 12-274N

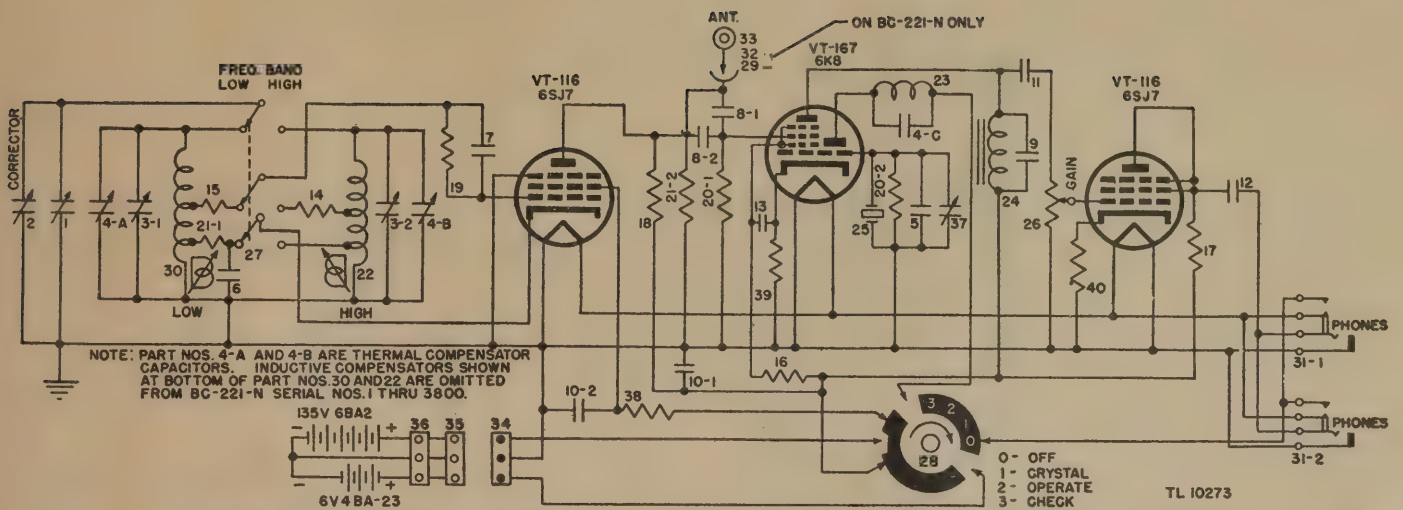


REAR (TERM.) VIEW OF ALL PLUGS & SOCKETS SHOWN.

RADIO RECEIVER & TRANSMITTER BC-788-B



NOTE:-
ALL CAPACITANCE VALUES GIVEN IN MAPD. &
ALL RESISTANCE VALUES GIVEN IN OHMS
UNLESS OTHERWISE INDICATED.
TUBE SOCKETS ARE DESIGNATED BY SYMBOL - X
FOR CORRESPONDING TUBE "V" NUMBERS

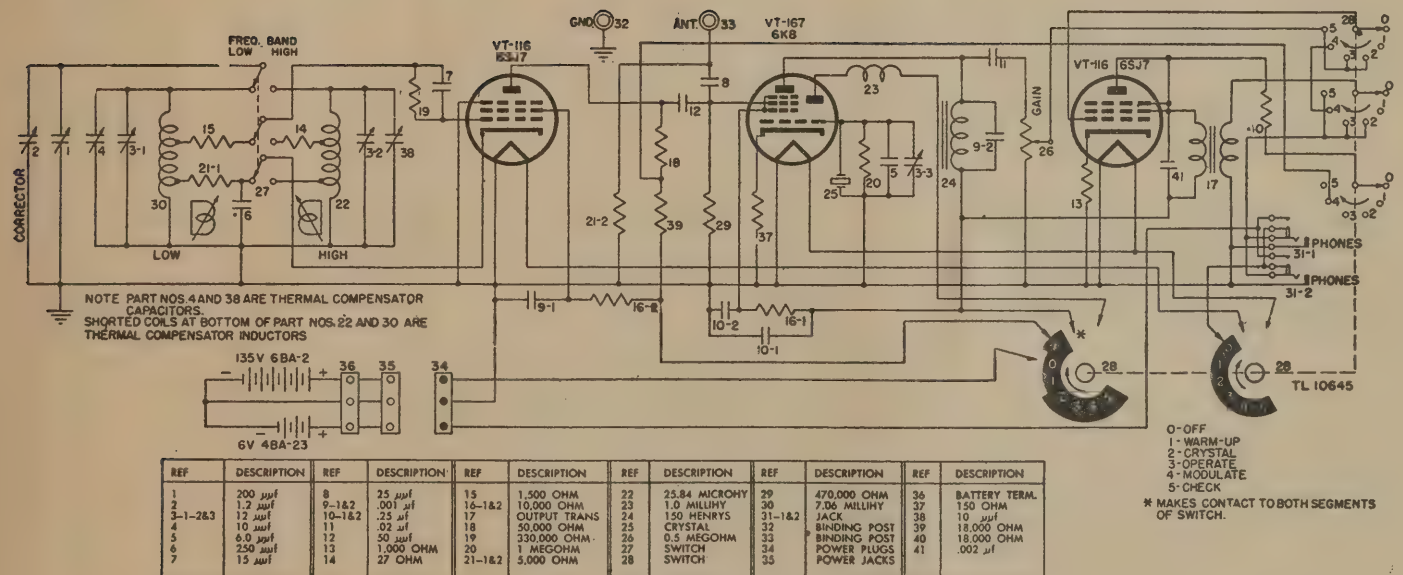


REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION
1	200 μ mf	9	.002 μ f	17	15,000 OHM	25	CRYSTAL	35	POWER JACKS
2	1.2 μ mf	10-1&2	.1 μ f	18	50,000 OHM	26	0.5 MEGOHM	36	BATTERY TERM.
3-1&2	15 μ mf	11	.25 μ f	19	330,000 OHM	27	SWITCH	37	12 μ mf
4-A,B,C	10 μ mf	12	2 μ f	20-1&2	1 MEGOHM	28	SWITCH	38	20,000 OHM
5	6.5 μ mf**	13	.001 μ f	21-1&2	5,000 OHM	30	7.06 MILLIHY	39	150 OHM
6	250 μ mf	14	27 OHM*	22	25.84 MICROHY	31-1&2	JACK	40	350 OHM
7	15 μ mf	15	1,500 OHM	23	735 MICROHY	33	BINDING POST		
8-1&2	25 μ mf	16	10,000 OHM	24	40 HENRYS*	34	POWER PLUGS		

*ON BC-221-N
REF. ITEM 14 IS 25 OHM.
REF. ITEM 24 IS 50 HENRIES
REF. ITEM 29 IS ANT. PLUG
REF. ITEM 32 & 33 BINDING
POST.
*ON EARLY MODEL BC-221-N
REF. ITEM 5 IS 6.5 μ mf.

Frequency Meters BC-221-N and BC-221-AA, schematic diagram.

FIGURE 1 - 221



REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION
1	200 μ mf	8	25 μ mf	15	1,500 OHM	22	25.84 MICROHY	29	470,000 OHM	36	BATTERY TERM.
2	1.2 μ mf	9-1&2	.001 μ f	16-1&2	10,000 OHM	23	1.0 MILLIHY	30	7.06 MILLIHY	37	150 OHM
3-1-2&3	12 μ mf	10-1&2	.25 μ f	17	OUTPUT TRANS.	24	150 HENRYS	31-1&2	JACK	38	10 μ mf
4	10 μ mf	11	.02 μ f	18	50,000 OHM	25	CRYSTAL	32	BINDING POST	39	18,000 OHM
5	6.0 μ mf	12	50 μ mf	19	330,000 OHM	26	0.5 MEGOHM	33	BINDING POST	40	18,000 OHM
6	250 μ mf	13	1,000 OHM	20	1 MEGOHM	27	SWITCH	34	POWER PLUGS	41	.002 μ f
7	15 μ mf	14	27 OHM	21-1&2	5,000 OHM	28	SWITCH	35	POWER JACKS		

Frequency Meter BC-221-AK, schematic diagram.

FIGURE 2 - 221

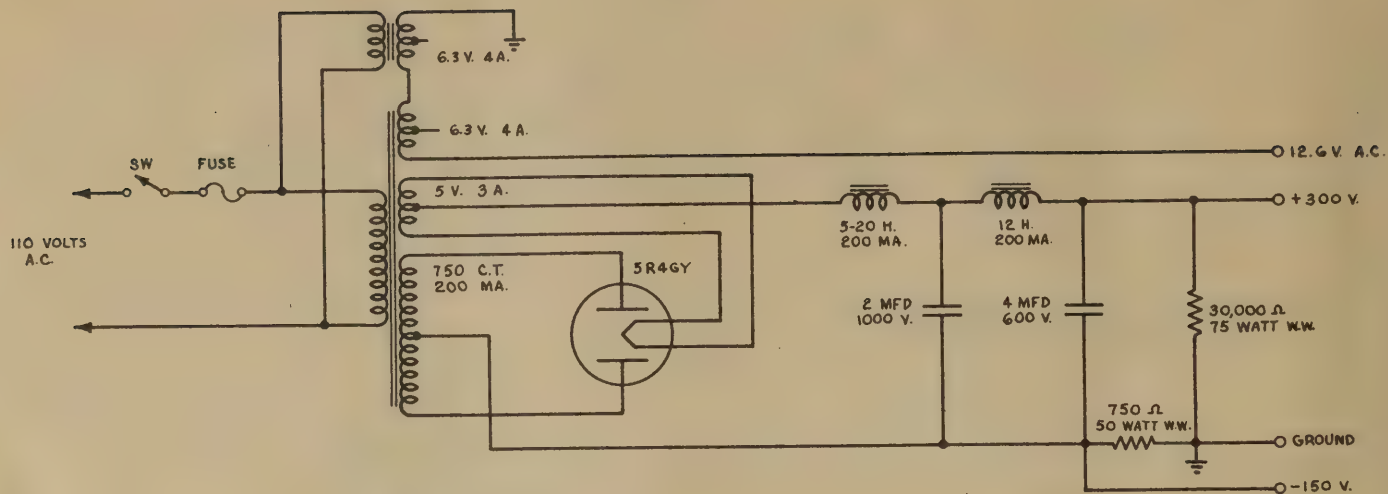


FIGURE 10 - 522

POWER SUPPLY SCR-522

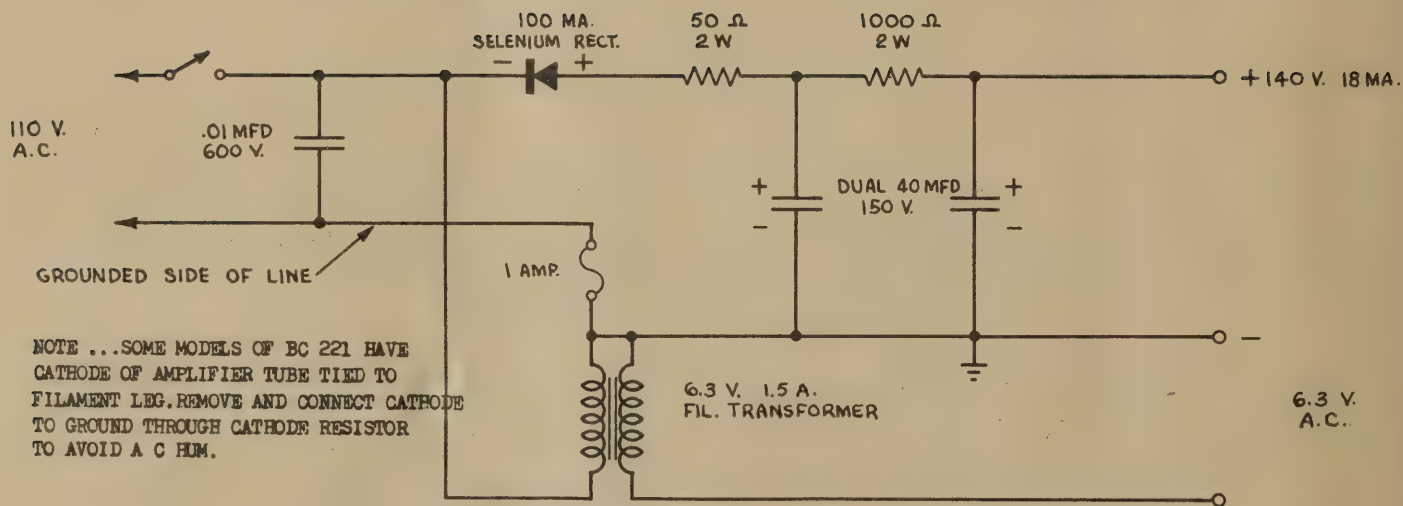
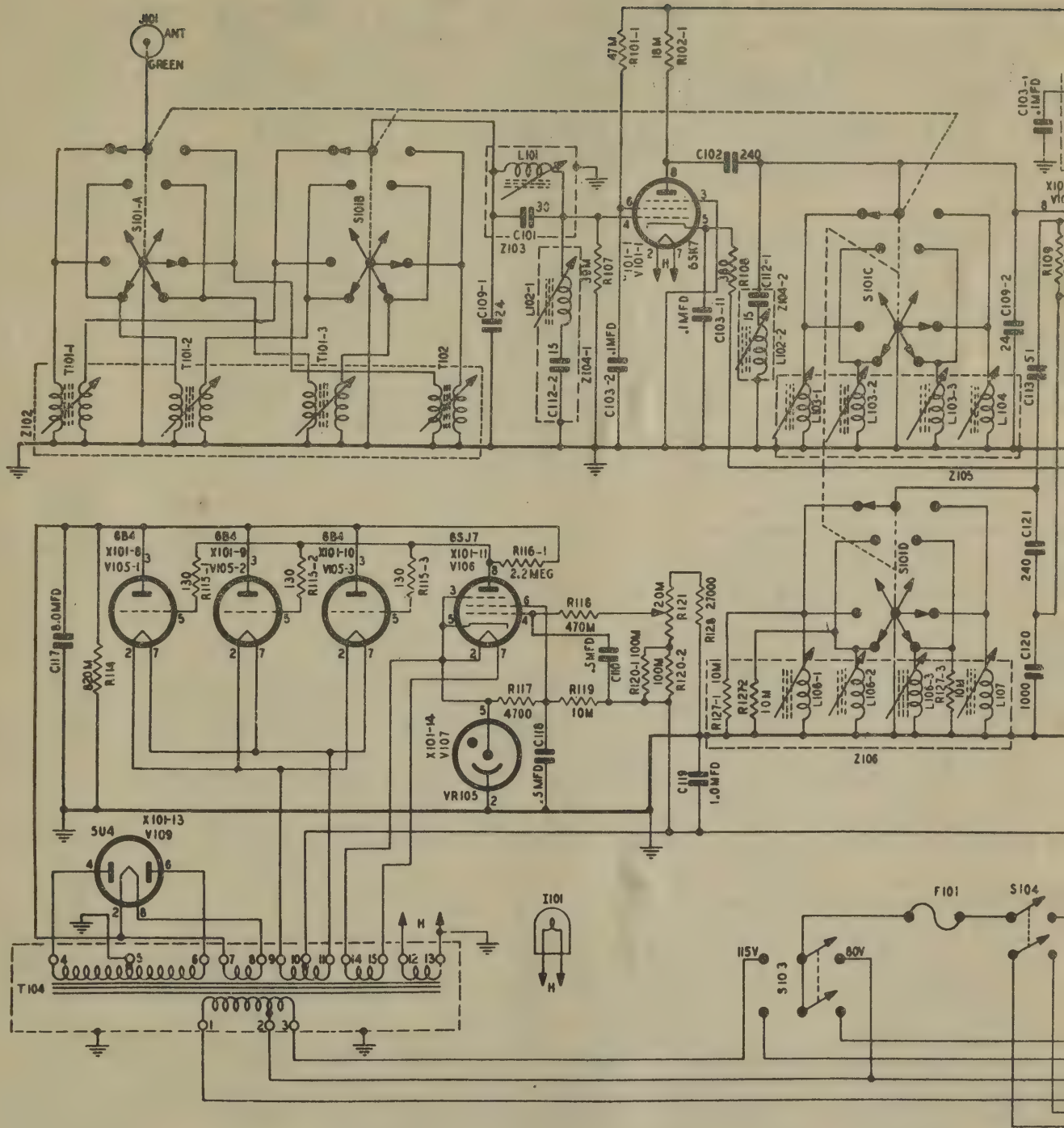


FIGURE 3 - 221

A.C. POWER SUPPLY FOR BC-221



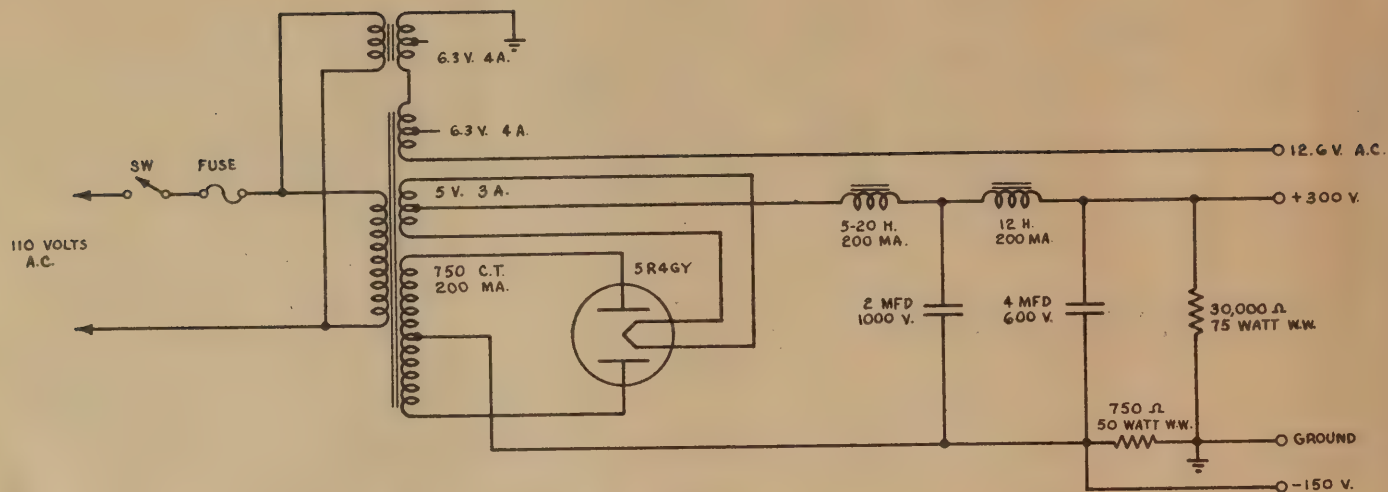


FIGURE 10 - 522

POWER SUPPLY SCR-522

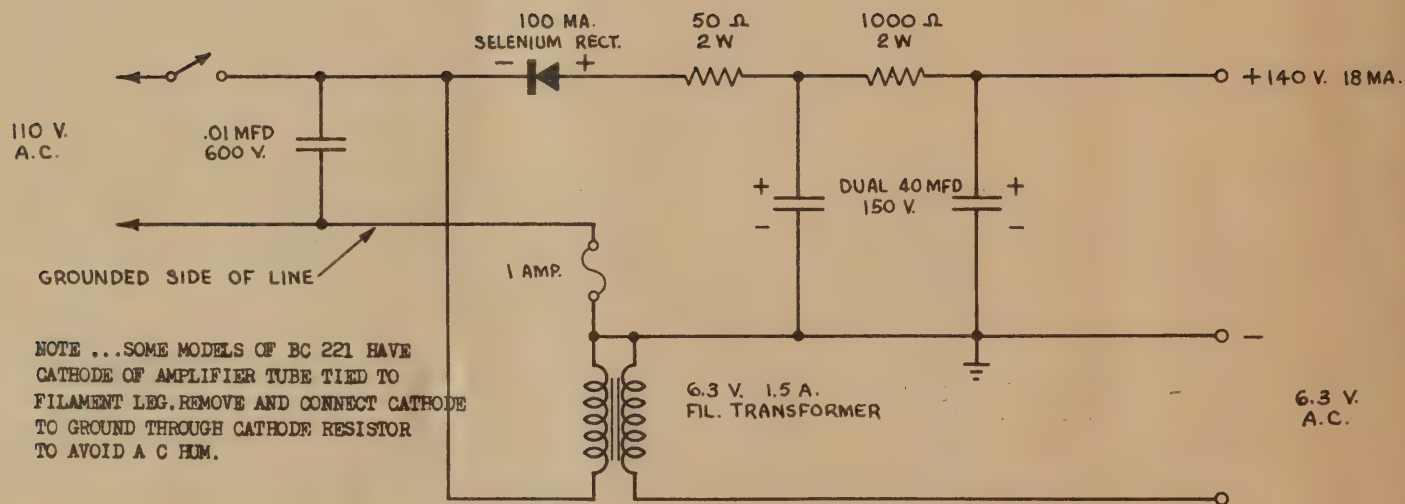


FIGURE 3 - 221

A.C. POWER SUPPLY FOR BC-221

